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SUPPOSED TENDENCIES TO SOCIALISM.*

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THERE are others besides Herbert Spencer who discern socialism as the end or logical outcome of certain tendencies which now prevail or which are thought to prevail; and, as all prophecies in modern times must be based on what we know of existing tendencies, supplemented by what history tells us of the course of similar tendencies in the past, it is a matter of importance to know how far such tendencies do really exist, and, if they do, to gauge, if possible, their probable momentum, and to judge whether they are likely to be permanent or passing, because confident prophecies have been hazarded on the strength of certain tendencies, while at the very moment of the prophecy a counter-tendency was setting in.†

The alleged tendencies to socialism are chiefly two: the tendency of the state to widen its functions, especially in the economic sphere; and the tendency to increased concentration of wealth. As to the former, there is no doubt that the modern state has a tendency to widen the range of its activity in the economic sphere, as also in the interests of culture, and this tendency is to a certain extent socialistic. The tendency exists; it has increased in England during the present century, especially since the passing of the first Factory Acts in 1844. It has increased especially in the legislative sphere, and as far as the regulation of industry is con-

* From Socialism New and Old, by William Graham. International Scientific Series, No. LXVIII. In press of D. Appleton & Co.

† As in the case of De Tocqueville's celebrated prophecy that nothing could stop the tide setting toward democracy and the equality of conditions, although a counter-tide toward a new inequality had already set in, with, as a consequence of it, the rise of a new aristocracy or plutocracy in all western Europe.

cerned; it will increase further in the interests of the health, the happiness, and the morals of the working class; so in like manner the tendency to assume industrial functions on the part of the central or the local government will increase. Nevertheless, this tendency will not increase fast nor go far, unless a second tendency, which we have now particularly to consider, should develop and show itself socially mischievous.

The second tendency is that toward the increased massing together or concentration of capital which has been going on all through this century, at first as a consequence of the industrial revolution and the needs of the large scale of production, then by the undertaking of ever larger enterprises requiring vast sums of capital, as in the making and working of railways—a tendency which first showed itself in the instance of the great individual capitalist, then in the company or union of capitalists, and lastly, within the past few years, in the syndicate or union of companies. This second tendency does exist; it is likewise an increasing tendency, and, under certain circumstances of abuse into which it would be tempted to fall, it might lead to socialism, not because of its affinities, since it is the very opposite of socialism, but by way of repulsion; it might lead to excessive government regulation, or to the superseding of the syndicates by government management in the interest of the public.

But, before considering the circumstances which might lead to such state socialism, it is necessary to clear away a mistake as to the concentration of capital, to point out a mistaken tendency, which, if it really did exist, would probably lead to socialism by a far shorter road—the mistake that the increasing concentration of capital, which is an undoubted fact, is an increasing concentration or accumulation in ever fewer individual hands; a mistake made conspicuously by Karl Marx, which was indorsed by Cairnes and Fawcett, and which lies at the bottom of all their desires to change the present industrial organization by substituting for it universal collectivism, as Marx would wish, or cooperative production, as the other two prefer.

According to Karl Marx, socialism will come when the process of evolution has resulted in a few colossal capitalists face to face with millions of exploited and expropriated proletarians, including many smaller capitalists who have been undersold and driven into the ranks of the proletariate. "When the constantly diminishing number of the magnates of capital has resulted in a few gigantic ones with a growing mass of misery, oppression, slavery, degradation, and exploitation"; and when, in addition, "the working class, increased in numbers, organized, disciplined, and united by the very mechanism of the process of capitalist production itself, is animated with a spirit of revolt," then, he declares, "the

knell of capitalist property will sound, the expropriators will be expropriated." But we can now see that Marx mistook the course of the industrial evolution, and that he prophesied without due allowance for other facts and forces that might check, or cross, or turn the tendency he thought he had divined.

According to Cairnes also, as we have seen, the tendency is to "an increased inequality in distribution. The rich will grow richer, the poor, at least relatively, poorer." And he recommends to the latter co-operative production as their sole hope. Now, Cairnes's mistake was the less excusable, as he wrote at a time (1874) when the tendency to great individual accumulation had received a check, and there were statistics available that might have tested his deduction. And, in fact, all that his argument really proves is that the *class* receiving interest (and occasionally wages of management, in addition to interest) tends to get a larger part of the produce than the *class* that lives by hired wages, or, as he puts it, that the wages fund tends to lag behind the other parts into which capital is divided. This last, if true, would still be a sufficiently serious thing, though Mr. Giffen, the eminent statistician, denies its truth; but, true or not, it is a quite different thing from the increasing concentration of wealth in individual hands, which Cairnes appears, in the above quotations, to think implied in it; that one class, and a large class, tends to get a somewhat larger share than another and a much larger class would not be a desirable thing if it could be prevented; it would scarcely be an argument for a total change in our industrial system, as desired by Cairnes, still less for the further social and political changes desired by advanced socialists.

According to Comte also (writing in 1850), the tendency was to the greater concentration of capital in the hands of individual capitalists; he thought the tendency a good one; far from desiring to thwart it by human volitions, he affirmed that the tendency would necessarily and beneficially lead to a more pronounced capitalism instead of to socialism, and with the capitalists ruling in the political as well as the industrial sphere—so differently did the philosophers forecast the future from the same assumed tendency.

Now, if the tendency were really to the concentration of capital in ever fewer hands, with a mighty mass of ill-paid and discontented workers, and with no great middle class lying between, then indeed the transition to socialism more or less complete would be much easier to accomplish, and in some shape it would probably come; at least it would be easier to expropriate a comparative few; it would be almost impossible to prevent it, the forces of might and justice added to envy being adverse, and with no mediating middle class. Both might and morality would

be on the side of the laboring class, and the fall of such a plutocracy might be safely prophesied. But Marx happily was mistaken as to the tendency. The tendency is not to the greater and greater fortunes of individual capitalists. That tendency did, however, exist during and for a certain time after the industrial revolution, especially in England, so long as she had a comparative monopoly of the continental as well as other foreign markets. And the tendency was so marked, it lasted so long, and some men became so rich, that Marx may be excused for generalizing too hastily from it, as undoubtedly he did. That tendency has now almost ceased in England, from increased competition, from the want of the old opportunities, from increased wages, from the spread of companies, and other causes; and though it did exist at the time Comte wrote, according to M. Leroy-Beaulieu it has ceased in France; the law, moreover, having there considerably assisted to check it by the equal partition of inheritances among the children.

The real tendency at present is to the greater massing together of separate portions of capital owned by many capitalists, small, great, and of moderate dimensions; to the concentration of capital certainly, but not to its concentration in single hands; to the union of capitals for a common purpose, while still separately owned. The tendency is to the creation of companies and unions of companies; to the transformation of the larger businesses into companies with larger capital, the original owner retaining a large portion of the shares, and possibly a large influence in the management, if the business is in a sound condition. The tendency is also to give business ability without capital chances of becoming rich through the management of such large concerns, and greatly to increase the number of directors of industry who, without being large capitalists, may in time become considerable capitalists.

The tendency to the concentration of capital, then, does exist as a fact, and socialism might conceivably come as the end of the tendency; only it will not come as the result of its concentration in the hands of a few mammoth millionaires, for the tendency is not toward such in any country save the United States, and even there the tendency is not marked, or it only shows itself in comparatively few instances. It might conceivably come as the result of a universal syndicate and monopolistic *régime*, which, if the monopolists greatly abused their position, might necessitate the state either to regulate stringently or itself to occupy and undertake those industries whose abuses proved incorrigible. But if a partial socialism came in this way, it would give the present system a much longer lease of life, both because the process of monopolistic occupation will probably be slow, and

because the capitalists of a given country will not be, as Marx prognosticated, a small number, but hundreds of thousands, probably millions, who would oppose a very powerful resistance to state occupation of a given industry, unless where such occupation was manifestly beneficial for the great majority.

The great multitude interested, the great number of owners of capital, whether in large or small portions, including the more intelligent artisans, would certainly make it difficult or impossible to expropriate them, would indefinitely delay the process, and only those industries could be taken over by the state the functions of which were discharged to the detriment of the community.

If indeed every province of production, distribution, and transport were occupied by syndicates and monopolies; if they abused the natural strength of the monopolist's position by raising prices to the utmost, and especially prices of the prime necessaries, while at the same time trying to reduce wages to the lowest point; if, in short, they were animated solely by egoism, and without conscience, or humanity, or public spirit, the public outside the industrial world, the large and intelligent middle class outside the industrial class, would probably side with the laboring class in pressing on the Government the suppression of the worst of them and the undertaking of their functions.

But, in the first place, the universal occupation of the industrial field by monopolies, and the extinction of competition, is very far off; in the second place, where any large combinations show too much corporate selfishness they can be pulled up by state supervision, and in certain cases great potential combinations can be nipped in the bud, their formation can be prevented by the state refusing permission to the companies to unite as "contrary to public policy" or to public interest; because a company is, in a certain sense, a creation of the state, as is likewise a union, and neither should exist, or receive permission of the state to come into being, if deemed likely to prove inimical to the general weal, so that the state could always check early or altogether the formation of possibly objectionable unions. Where, as in a case like that of railways, they were necessary, it would not be desirable to prevent their formation; they could always be checked if they abused their position, and conditions should always be attached to the concession of powers and privileges to them. It is, therefore, extremely unlikely that the industrial field will ever be occupied by a few colossal and irresponsible syndicates, or that the state will be driven to substitute itself for them, save possibly in a very few cases.

Lastly, the syndicates would have to be devoid not only of conscience, humanity, public spirit, but also, what we can less

easily suppose to be absent, common sense and prudence, if they tried to extort the highest prices in cases of necessaries supposed to be controlled by them, or, on the other hand, to reduce wages to the lowest point, on the ground that laborers had no alternative work; such would be dangerous policy for themselves, though no doubt there would be a temptation to it which might prove too great for some employers. Only in such a case of abuse would the state be called upon to interfere, and either strictly regulate or itself undertake the function abused.

But the result of these several considerations is to put off universal socialism indefinitely as a natural evolution, and points merely to the introduction of such partial applications of state socialism as peremptory public exigence may require, in those cases where a social function could not be intrusted to private enterprise, whether monopolistic or competitive.

There is also the tendency on the part of the laborers to co-operative effort, from which some people expect the elevation of the laborers and the composing of the quarrel between capital and labor by merging the two; and this tendency does certainly exist; it is, moreover, in the direction of socialism in the widest sense of the word; only it is a much slower tendency, and a smaller one, more especially in the field of production, as already stated. Of the two tendencies, one to co-operation on the part of labor, and one to the spread and consolidation of companies on the part of capital, the former will not develop fast enough. The company will develop much faster, and socialism might much sooner come as the term of that evolution unchecked than through co-operation. But the one might be restrained by the state, the other might be quickened; the state might become the workingman's bank, to some extent, as it has been the creditor of the farmer in Ireland; it might lend at market rate, three or three and a half per cent, to such associations of workers as had saved a moiety of capital, if they could show the likelihood of success in their projected enterprise. But as this point has already been considered, it is not necessary to enlarge on it here any further than to say that the working classes, now that they have got so much political power, may not improbably press for some state assistance to increase the numbers of owners of capital, especially as the results of unaided efforts must be extremely small and slow.

What political action to improve their economical position they may take can not be precisely stated. It is by no means likely that they will ever combine to demand a maximum working day in England. They will not ask the help of the state for the purpose; nor will they, with the socialists, ask it to fix a minimum of wages, which they can if they choose themselves fix through trades-unions. They may ask for the nationalization

of the land; though it is not clear, if landlords were compensated, what they would gain by it beyond the creation of small farmers, the granting of allotments to agricultural or other laborers, as an occupation for slack times, all of which may be secured otherwise: so that it is not easy to forecast the resultant line of action of the working classes, more especially as the interests of the skilled and unskilled laborers are not always identical, however the desires for higher wages and fewer hours may be common to both.

Thus far as to the existing tendencies. As to the final goal, it is very difficult to say what it will be, or what the end in which society will rest (if, indeed, it ever attains to rest other than provisional equilibrium). And it is difficult because of the new and unforeseen factors that arise in the course of an ever-expanding evolution which might upset our calculations. New factors, industrial, social, moral, religious; new physical discoveries, like steam or electricity, that might revolutionize industry; new moral or religious forces that might revolutionize manners and the scheme of life, and with it indirectly the distribution of wealth; and great physical discoveries and inventions affecting industry—we may indeed certainly look for as in the normal course of evolution.

Society *may*, indeed, come to the collective ownership of land and capital, but it will not be for a long time; it *may* come to equality of material goods, but it will be at a time still more remote. On the other hand, the system of private property and freedom of contract may last indefinitely or forever; but, if it does, we may safely prophesy that it will be brought more in accordance with reason, justice, and the general good, and, though there be never equality of property, there will be a nearer approach to equality of opportunities, and a somewhat nearer approximation of the existing great extremes of fortune.

Eminent writers during the past hundred years have prophesied far more confidently as to the future: Karl Marx, as we have seen, that the concentration of capital in the hands of a few would lead, naturally, necessarily, and at no distant date, to their expropriation, and to a collectivist *régime;* and De Tocqueville, that society was being borne invincibly to a state of general equality of conditions, where the state would continally become more powerful. On the other hand, the sociologists, who, if their science were all that its name implies, should be able to forecast the future, "to look into the seeds of time and say which grains would grow and which would not," predict very differently: Comte, that the concentration of capital in ever fewer hands would and should lead definitely to the political rule of the capitalists, tempered by the counsel of positive philosophers, and that within a short space of time; while Herbert Spencer, as we have already seen, filled

with the doctrine of evolution, and impressed with the lesson it teaches as to the length of time required for changes for the better, discerns at "the limits of evolution," countless generations hence, as goal, a system of property and contract, purified and supplemented by voluntary benevolence, with the authority of the state reduced to a minimum.

In like manner Mill prophesied; but his conclusion was different. He prophesied that co-operative production, "sooner than people in general imagined," would transform society by superseding the capitalist employer; and with respect to the two exactly opposite prophecies of Mill and Comte, all that need be said is that neither of them has been as yet fulfilled. Co-operative production has not advanced, nor, on the other hand, has the capitalist attained supreme political power, though of the two perhaps the prophecy of Comte has come nearer to fulfillment.

When De Tocqueville wrote his remarkable book on "Democracy in America," the new tendency to inequality had not shown itself in America, there *was* great equality of conditions, and there was likewise considerable equality of conditions in France as a consequence of the Revolution. De Tocqueville generalized from what he then saw, and prophesied a further and a general equality, though somewhat prematurely, because a tendency to a prodigious inequality was setting in at the time he was writing, a tendency first manifested in England, that increased, spread, embraced the civilized world, that was followed by a new social conquest, and the rise of a new and potent moneyed aristocracy. It grew greater; and, generalizing from this tendency, Karl Marx prophesied it would grow still greater until all capital was concentrated in a few hands; the capitalists would then be expropriated, and socialism and equality would come. But Marx, as already stated, based his prophecy on a misread tendency, a short tendency which had spent its full force before he died, just as De Tocqueville based his prediction on a supposed tendency gathered from the facts of a generation earlier. Both were wrong: a great current toward inequality came, especially in America, after De Tocqueville wrote, in 1835, just as there came a check to the concentration of capital in fewer hands, and a tendency to its dispersal, before Marx died.

Others also have prophesied in our century, though without pretending to base their predictions on the scientific study of political or social phenomena: St. Simon, that the golden age was in the future, and that society would reach it through his doctrine; Carlyle, that the abyss lay before society, unless the Great Man appeared to save it. To the like effect the poet-laureate also speaks: "Before earth reach her earthly best a God must mingle with the game."

What is the lesson to be gathered from the prophets and writers on the science of society? Not that we should expect an early and radical transformation of society; neither the supremacy of a few capitalists, nor yet their early expropriation; hardly even that we should expect the coming of the semi-divine man of Carlyle and Tennyson to set things right. The chief lesson is the rashness and exceeding doubtfulness of specific prophecies which are grounded as often on hopes or fears, likes or dislikes, as on superior insight. The prophets are, however, in general optimistic; they believe in progress or evolution; and they believe that civilized society is progressing to something better than the present state, though they differ considerably as to what constitutes that better. I share this faith, on the whole, myself. I believe that society is in movement as part of an inevitable process to something better in the end, though some of the stages to it may appear to be really worse for particular generations. I believe we are moving toward a better, to "a far-off divine event" which can not be fully perceived at present; and I believe that the road to it lies through something better than the present which can be perceived. To get to this better will require the co-operative efforts and volitions of men, especially of the working classes, and of their leaders. Social thinkers will be required to furnish light and guidance, and also, it may be, great statesmen filled with the spirit of understanding and justice, and with regard for the general good. There will be neither miracle wrought, nor sudden social transformation, which would be a miracle in order to last; but with good sense, self-reliance, and persistence on the part of the many, assisted by the light and help of the few, and with better dispositions on the part of employers of labor, a considerable advance for the whole people, and especially for the cause of labor, might be made during the present generation; while, with these same conditions as permanent facts, the movement for social reform, if not the socialistic movement, will advance as fast as is desirable, and will realize in future as much good as the nature and complexity of things social and things human will allow.

THE scheme for an exploration of the antarctic regions is gradually assuming shape. A report was made at the meeting of the Royal Geographical Society of Australasia in August, that Baron Nordenskiöld would consent to take command of an expedition on condition that the Australian colonies contribute five thousand pounds toward the expenses, to be met by a like contribution by Nordenskiöld's friend Baron Oscar Dickson. The Geographical Society, which had already pledged itself to support a South Polar Expedition, accepted the proposition of the Swedes at once, on the faith that the necessary subscriptions would be secured, and itself contributed two hundred pounds toward the amount.

THE DEVELOPMENT OF AMERICAN INDUSTRIES SINCE COLUMBUS.

IV. IRON-WORKING WITH MACHINE TOOLS.

By WILLIAM F. DURFEE, Engineer.

WHILE the builders and operators of blast-furnaces were achieving such splendid results as have been described, the owners, managers, and engineers of rolling-mills were not idle. At the very beginning of rolling-mill construction in America the disposition to make improvements in known methods and to invent entirely new mechanisms and processes was promptly manifested. Even in the first mill of which we have any authentic account the rolls and heating furnaces were decided improvements on previous practice; and from that day to the present time the best American rolling-mill practice has been characterized by originality of idea and perfection of construction. Fig. 41 is a longitudinal sec-

Fig. 41.—Longitudinal Section of a Heating Furnace.

tion of a heating furnace in which coal was used as a fuel. The "fire-box" with its grate is seen at the left; to the right of this is the "bridge-wall" separating the "heating chamber" from the "fire-box." The bottom, *a*, of the "heating chamber" is made of silicious sand. On the extreme right of the furnace is seen the "cinder-tap," *b*, for the discharge of any liquid "cinder" made during the operation of heating the iron; near this "cinder-tap" is the lower part of the "chimney-flue." The iron to be heated was placed upon the sand bottom *a*, and the flame from the fuel in the fire-box passed over it, not only heating the metal directly but the roof and side walls and bottom of the heating chamber also, which, as was said when this form of furnace was first intro-

duced, "reverberated" more heat upon the metal; hence the name "reverberatory furnace" often applied to such structures. The walls, roof, fire-bridge, and chimney-flue are built of very refrac-

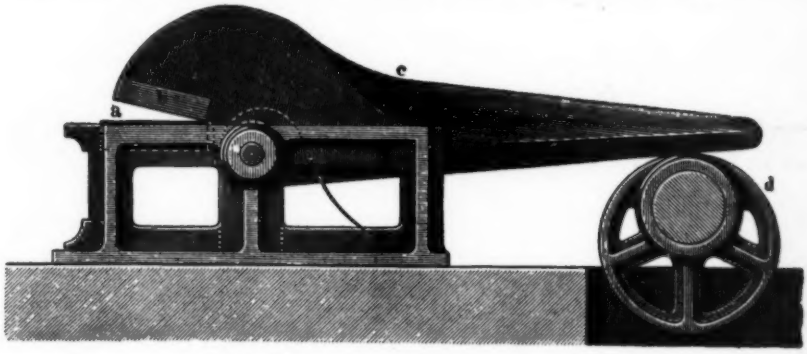

FIG. 42.—LEVER SHEARS FOR CUTTING BAR IRON.

tory brick, called "fire-brick." Furnaces of similar construction (sometimes called "air-furnaces") are used for melting pig iron for making heavy castings; but in these furnaces, instead of a

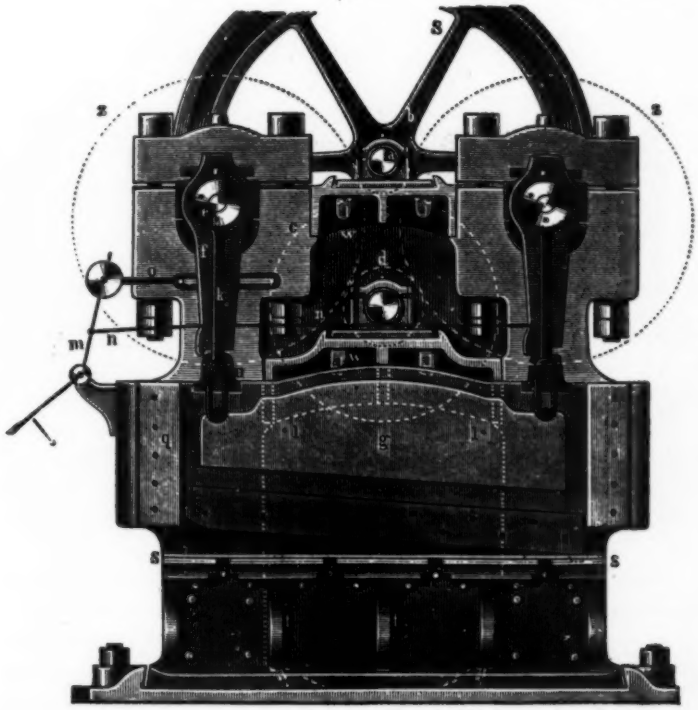

FIG. 43.—FRONT ELEVATION OF BOILER-PLATE SHEARS.

sand bottom of the form shown at *a*, the furnace at this part has its bottom depressed so as to form a basin to hold the fluid

metal. Thirty to fifty tons of metal are sometimes melted in such furnaces.

Among the machine tools used in rolling-mills those called by the general name of "shears" occupy an important place; these tools vary greatly in form and constructive detail, and are designed with especial reference to the work for which each is intended. Fig. 42 is an illustration of a common form of lever shear for cutting bar iron. The cutting knives are located at *a b*, and when the eccentric *d* is revolved by the rotation of the shaft on

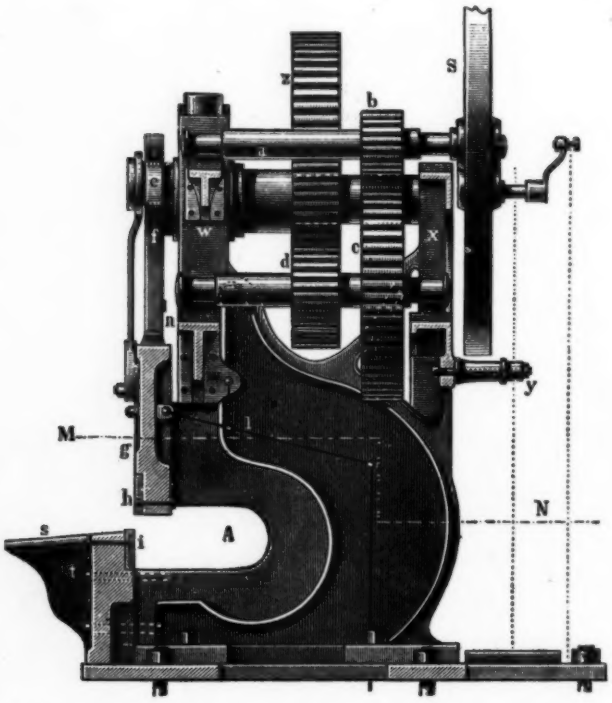

FIG. 44.—END VIEW AND TRANSVERSE SECTION OF BOILER-PLATE SHEARS.

which it is placed, it lifts the long arm of the lever *c* and causes the upper knife *b* to cut or "shear" past the lower knife *a*, thus dividing any bar of iron that may have been between the two knives.

Fig. 43 is a front elevation of a "shear" for cutting boiler plate, and Fig. 44 is an end view and transverse section of the same machine.

In Fig. 43 at *g* is seen a large mass of cast iron, to the lower edge of which is attached a long, inclined cutting knife, which is designed to operate in conjunction with a straight knife attached to the frame of the machine (the relative positions of the two knives are shown in Fig. 44 at *h* and *i*) to shear any sheet metal

placed between them. The "gate" *g*, to which the upper knife is attached, has a vertical reciprocating motion communicated to it by means of the eccentrics *e* and the rods *f*, and, as the upper knife *h* has an inclined edge, the shearing will commence on the right and gradually extend to the left as the "gate" *g* descends. Shears of this description have been made to cut ten feet in length at one movement of the "gate" *g*. Such tools are very heavily geared, and are usually driven by a special steam-engine.

The first iron-works in the United States in which iron was puddled and rolled into bars was built by Colonel Isaac Meason, in 1816 and 1817, at Plumsock, on Redstone Creek, between Connellsville and Brownsville, in Fayette County, Pennsylvania. Swank tells us that "Thomas C. Lewis was the chief engineer in the erection of the mill, and George Lewis, his brother, was the turner and roller. They were Welshmen."

We have no exact description of the machinery of this mill, but we are told that, in addition to the rolls, "the mill contained two puddling-furnaces, one refinery, one heating furnace, and one tilt-hammer"; and that "the iron was refined by blast and then puddled." This mill produced "bars of all sizes, and hoops for cutting into nails." The mill was started on September 15, 1817,

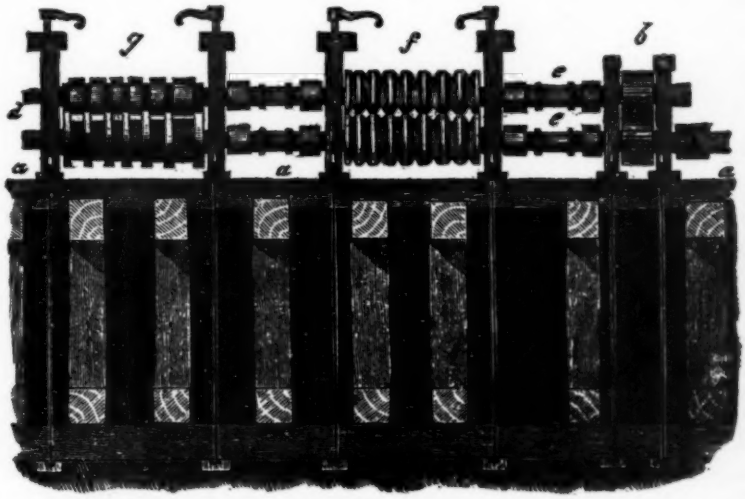

Fig. 45.—Train of Rolls for Square and Flat Bar Iron (1817).

and continued in operation until 1824, when it was destroyed by a flood, and never rebuilt. Although we have no details of the roll train used in this mill, it is fair to assume that, as its designers were Welshmen, they followed as closely as possible the practice with which they were familiar. Fig. 45 is an elevation of a train of rolls such as was in common use in England and Wales at the beginning of this century for rolling square and flat bar

iron. In this figure, *a* is the foundation sill of the mill. This sill rested upon some heavy frames of timber, which in turn were supported by a pair of bottom sills; the "stands" or "housings" in which the rolls turned were placed directly on the timber sills, *a*, and secured by long bolts that passed through the lower sills. At this period, and for some years thereafter, in fact, timber foundations for rolling-mills were considered absolutely necessary, in order to impart a certain degree of elasticity to the machinery; and when we consider the rude way in which all machinery was constructed at that time it is not improbable that some elasticity was essential to its operation.

In Fig. 45, at *b*, are seen the "pinions," which were a strong pair of toothed wheels of the same diameter which served to insure an equality of rotation in the top and bottom rolls of the mill. These pinions were connected with the rolls by the spindles *e e*. The rolls at *f* could be used to make square bars, or to "rough down" the iron preparatory to passing it through the rolls *g*, which were intended for flat bars of various widths and thicknesses. This construction of rolling-mill is what is known as a "two-high train," and is so called from the fact that each pair of "stands" or "housings" contains but two rolls placed one above the other. It is obvious that, as the rolls revolve constantly in one direction, the iron, after passing through one of the grooves, would have to be returned over the "top roll" before it could be passed through the next groove for further reduction in section and extension in length. It is also evident that such a method of working wasted half the time and a large amount of the heat of the metal; but, notwithstanding these and other quite as serious objections to this form of mill, it continued in use until a very recent period, and it is possible that even now there may be found, in localities uninfluenced by the spirit of progress, some examples of this rotary antiquity still in operation.

Up to the year 1844 the rolling-mills of the United States produced little else than bar iron, hoops, and nail plates; all the early railroads had been equipped with strap rail (flat bar iron provided with "countersunk" holes at proper intervals, through which passed the spikes by which the "rail" was secured to longitudinal stringers of wood), which could easily be rolled in this country; or with imported T or H rails. The T rail is of American origin, it having been invented by Robert L. Stevens, President and Engineer of the Camden and Amboy Railroad. Mr. Stevens had the first of these rails rolled at Dowlais Iron Works, in Wales, and they were laid in the track of the Camden and Amboy Railroad in 1831–'32.

The first heavy railroad iron of America manufactured was made at the Mount Savage Rolling Mill, in Alleghany County,

Md. This mill was designed expressly for this class of work. The first rail rolled was what is known as the U rail, and for this the Franklin Institute awarded its silver medal in October, 1844. Such was the demand for railroad iron that other mills for its

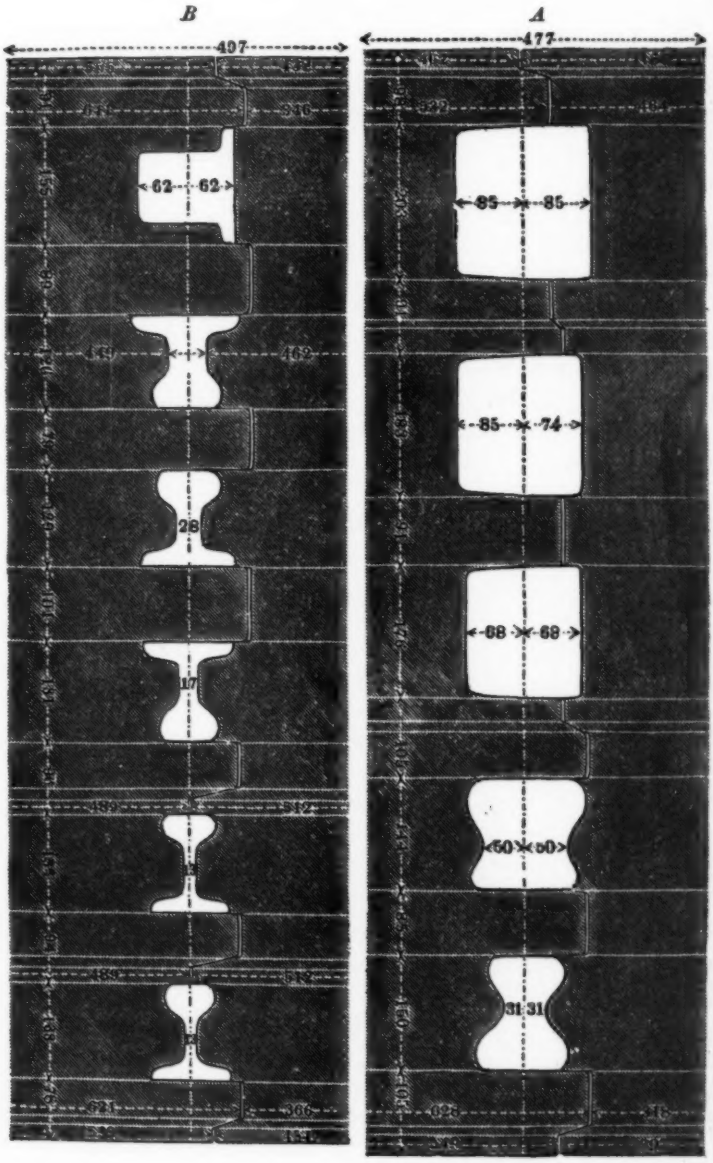

FIG. 46.—"GROOVES" IN ROLLS OF "TWO-HIGH TRAIN" FOR ROLLING RAILS (1850).

production were rapidly constructed. The Montour Rolling Mill at Danville, Pa., was built in 1845, and in October of that year turned out the first T rails made in America. On the 6th of

May, 1846, the Boston Rolling Mill made its first T rail, and on the 19th of June, 1844, the rolling-mill of Cooper & Hewitt, at Trenton, N. J., commenced rolling rails. About the 1st of September, 1846, the New England Iron Company, at Providence, R. I., made their first rail. Railroad iron was rolled at Phœnixville, Pa., in November, 1846, and about the same time at the Great Western Iron Works at Brady's Bend, and at the Lackawanna Iron Works at Scranton, Pa. Rails were also rolled, early in 1847, at the Bay State Iron Works in Massachusetts; in January, 1848, at the Rough-and-Ready Rolling Mill at Danville, Pa., and in the same year at Safe Harbor, Pa., and at Avalon, Md. Some few other mills rolled rails prior to 1850, but at the beginning of that year, owing to the severity of foreign competition, only two out of the fifteen rail mills in this country were in operation.

The rail trains in all the above-named mills were "two high"* (that is, one roll above another in pairs), and a general idea of the forms of the several "grooves" or "passes" in the rolls used in a two-high rail train may be derived from an inspection of Fig. 46. A two-high rail train comprised two pairs of rolls, one pair being called the "roughing rolls" and the other "the finishing rolls." Their general relations to each other were quite similar to the rolls of the "bar-mill," shown in Fig. 45.

In Fig. 46, *A* represents the five "passes" in the "roughing rolls," and *B* the six in the "finishing rolls." The progress of the metal was from left to right, through each of the "passes" in each roll successively. We have no space to describe in detail the peculiar features of the three-high train; but its more prominent peculiarity consisted in the fact that there were three rolls in each pair of housings, and that the "rail," or other form of bar being rolled, was passed between the middle and "bottom roll" and returned between the middle and "top roll," and received compression and extension at each "pass."

Fig. 47 gives a very life-like view of the interior of a rolling-mill as constructed about the year 1855. It will be noted that the "trains of rolls" are all "two-high," and that the building is evidently constructed of wood; and the large number of men employed is also a conspicuous feature. To those at all familiar

* For the manufacture of heavy "bar iron" and "structural shapes" ("beams," "channel bars," "angle" and "tee iron") the "three-high rolls" are a development of American practice due to the ingenuity and practical sagacity of the brothers John and George Fritz, who erected the first mill of this kind for rolling rails at the Cambria Iron Works at Johnstown, Pa., in 1858. Such were the manifest advantages of their system that it was at once adopted by many of the larger rolling-mills, although as late as 1865 there were a few mills rolling rails on the old "two-high trains." I well remember advising in 1862 the removal of an ancient "eighteen-inch two-high rail train," and the putting in its place of a "twenty-one-inch three-high train," and the opposition and ridicule over which that advice finally triumphed.

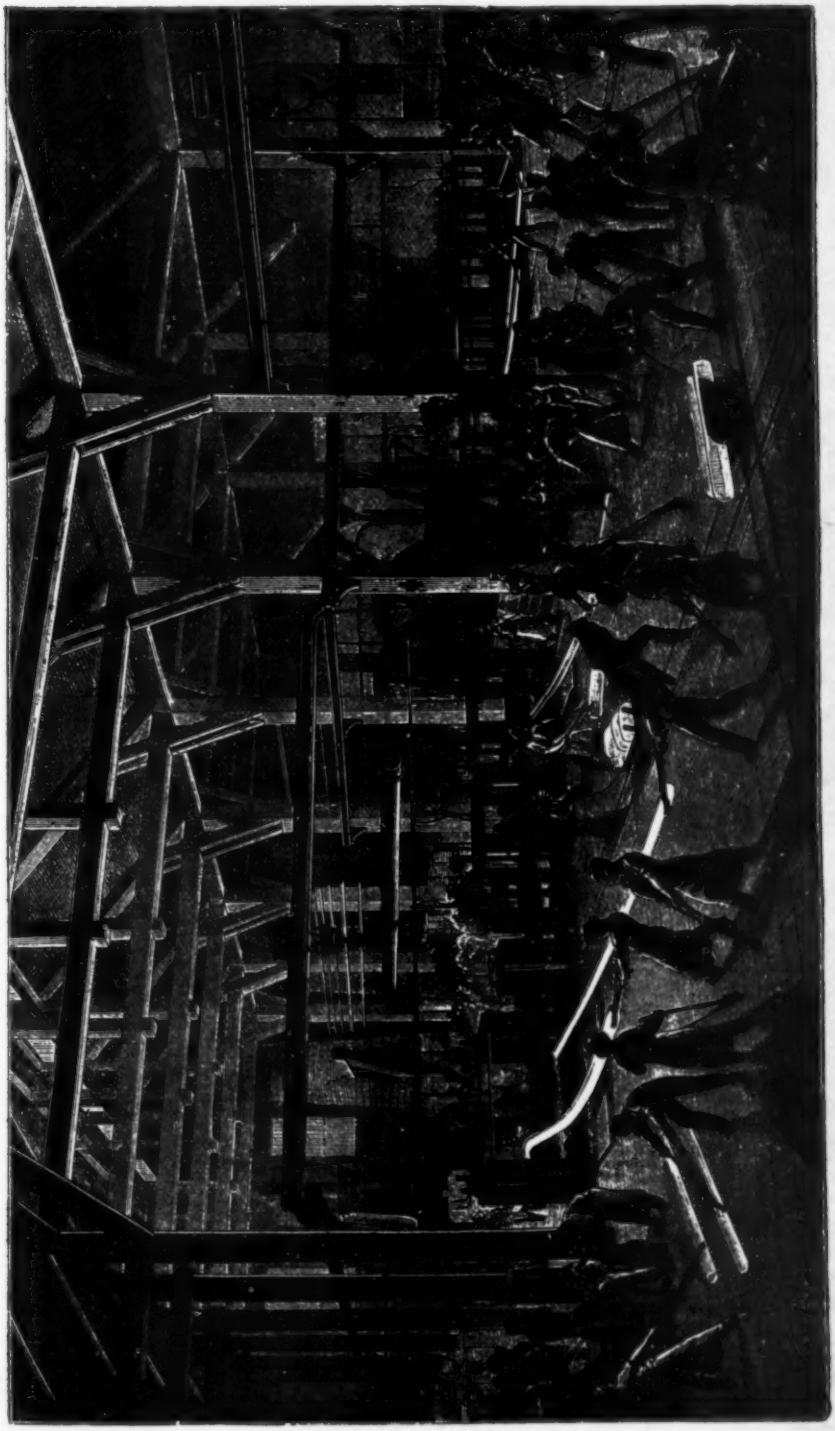

FIG. 47.—INTERIOR OF A ROLLING-MILL (1855).

with such establishments, it will require but a slight effort of the imagination to impart to the picture all the attributes of real life; and to fill the sooty air with the hissing of steam, the jigging jingle of coupling-boxes and spindles, and the groaning of rolls, among which sounds are injected the resounding blows of a steam hammer, answered by the clattering scream of a "cutting-off saw," mingled with the hum of revolving wheels, and scores of minor sounds and reverberations; over all, the lurid glare of furnaces and hot iron, amid which the busy workmen move in orderly activity at the work in hand; the whole making a scene in which the strength of man and iron, the energy of fuel and fire, and the power of steam and machinery are combined as in no other industry on the surface of the round world.*

The rolls for making heavy bar iron of a rectangular section, hitherto described, have been provided with a number of "grooves" or "passes" of varying dimensions suited to the sizes of the bars required; but the manifest objection to this very common arrangement is that, in order to be able to produce a large variety of bars, a great number of rolls must be kept in stock. But the mill represented in Fig. 48 is so contrived that it will roll an almost unlimited number of sizes of rectangular bars by the use of a combination of four plain cylindrical rolls, two of which revolve on horizontal axes, and the other two on vertical ones. In the figure, for the purpose of clearness, the driving mechanism of the vertical rolls is omitted. Each of the pairs of rolls is driven at an appropriate velocity, and is adjustable, so as to adapt their relative positions to the particular cross-section of bar about to be made. The horizontal rolls can be adjusted vertically and the vertical rolls horizontally, and therefore any proportion of width and thickness can be turned out, up to the limitations imposed by the width of the cylindrical portion of the horizontal rolls and the length of the body of the vertical rolls. This highly ingenious mechanical combination was invented by Herr Daelen, a German engineer, and it was first erected

* The Plutonic appearance of most iron-works was fully appreciated by the poet Burns. Sir John Sinclair, in his Statistical Account of Scotland (1797), states that the "Ayrshire poet" was refused admission to the Carron Iron Works, and, "upon returning to the inn at Carron, he wrote the following lines upon a pane of glass in a window of the parlor:

"'We cam na here to view your warks
In hopes to be mair wise;
But only, lest we gang to hell,
It may be nae surprise.
But when we tirl'd at your door,
Your porter dought na bear us;
So may, should we to hell's getts come,
Your billy, Satan, sair us.'"

at the works of Piepenstock & Co., belonging to the Hörder Society, in 1848. It found its way to America about twelve years later; but it has not received the attention from American engineers that the value of its constructive ideas justifies.

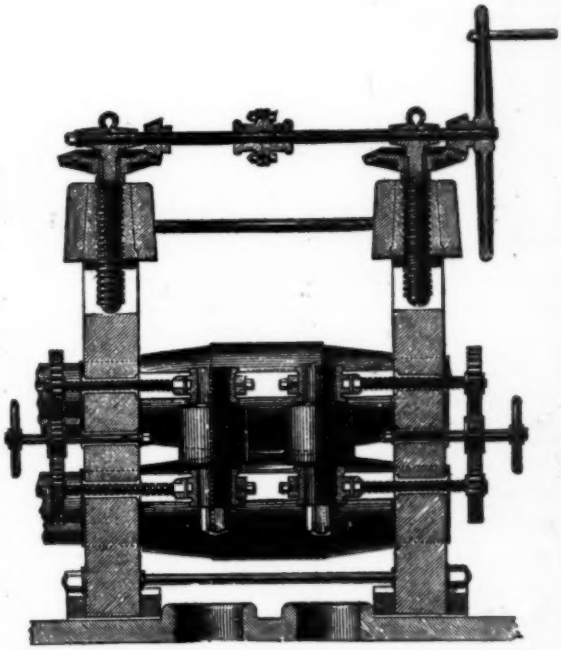

FIG. 48.—UNIVERSAL MILL.

The first iron beams for use in buildings rolled in America were made in the mill of Messrs. Cooper & Hewitt, at Trenton, N. J., in the spring of 1854. They were seven inches deep, weighing about eighty-one pounds per yard. They were used in the construction of the Cooper Institute and the building of Harper & Brothers, and also by the Camden and Amboy Railroad for rails. A special "train of rolls," the invention of William Burrows, was constructed for doing this work. An elevation of the "finishing rolls" of this "train" is given in Fig. 49. It will be seen that there are three short rolls, A A A, whose axes are vertical and supported by a cast-iron frame or housing, D D. Besides these vertical rolls there are two horizontal rolls, E E. The power was transmitted to the mill from the main driving-shaft B, through the bevel gearing B^1, B^2, the three spur-gears B^5, and the spindles B^8. This was the only mill of its kind ever erected, and after a few years it gave place to a "three-high train," which is the kind of mill exclusively used in America at the present time for the manufacture of the various forms of "beams," etc., known as "structural shapes."

The space available will not permit of a detailed description of the various improvements in machinery and methods that have been brought forward within the last thirty years, and we can only briefly mention the more prominent.

In 1859 John and George Fritz (*par nobile fratrum*)* patented

* A noble pair of brothers.

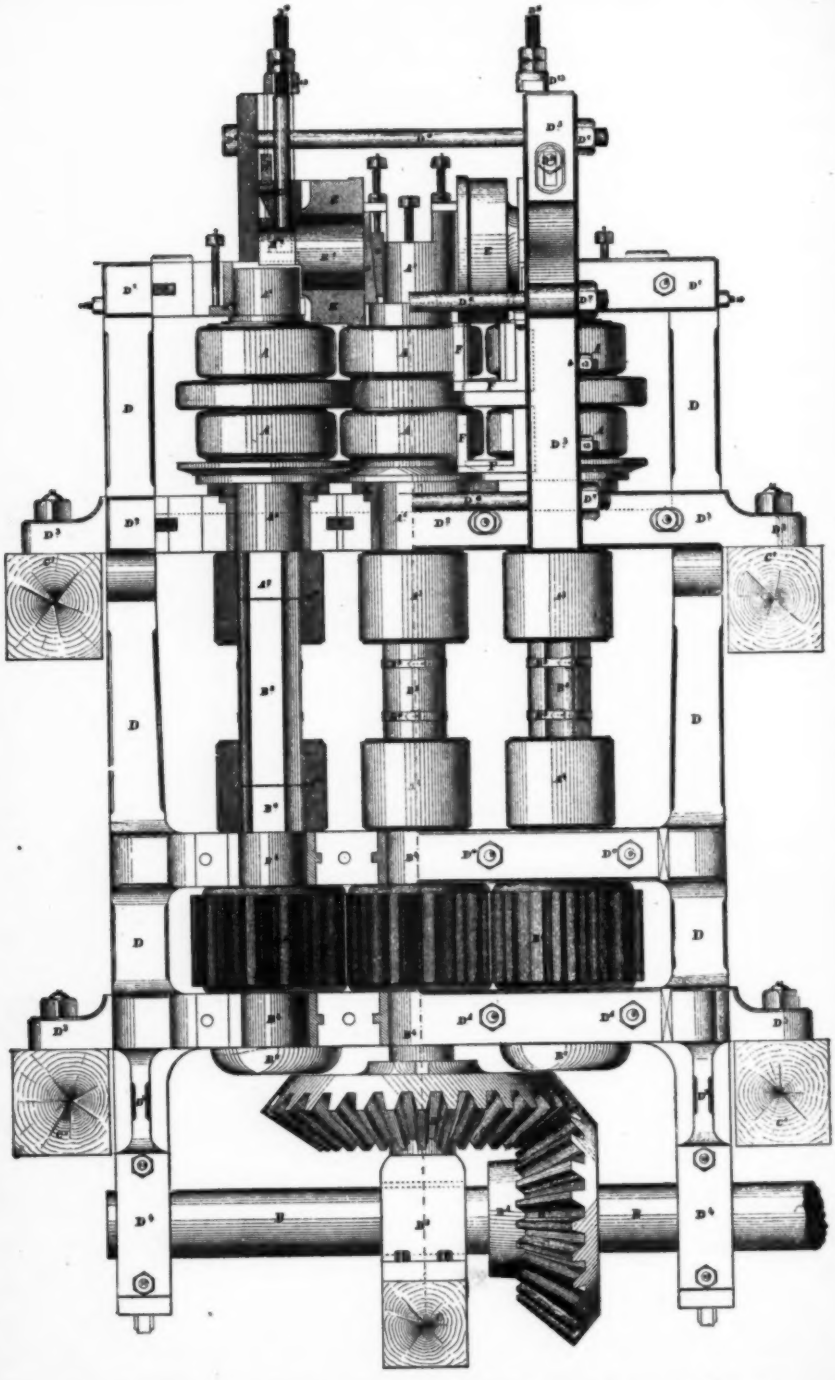

FIG. 49.—ELEVATION OF "FINISHING ROLLS" FOR BEAMS—COOPER & HEWITT.

important improvements in "three-high" mills, embracing what is known as the "feed-roll" and "hanging guides." In 1864 Bernard Lauth patented the well-known form of "three-high mill" (often called "Lauth's mill") for rolling boiler plate and sheet iron. In 1872 James Moore and John Fritz patented a "three-high train," having a fixed middle roll and an adjustable top and bottom roll; and in the latter part of the same year George Fritz patented "feeding tables having driven rolls" for "three-high trains."

In December, 1873, James Moore, William George, and Alexander L. Holley patented a "three-high blooming train," having an adjustable middle roll. The first mill of this kind was made by James Moore, of Philadelphia, and was put at work in the Bessemer Steel Works at Troy, N. Y., by the late A. L. Holley, who was then manager of these works.

Among the more recent improvements in the manufacture of iron and steel the use of gaseous fuel stands conspicuous. The idea of first converting the fuel into a combustible gas, and conveying this to the point where heat was required, and there igniting it, is a very old one,* and, in one form or another, it has been employed for over a thousand years; but it is only within the present century that the manifold advantages of gas as a metallurgical fuel have become fully recognized by the iron and steel workers of the world. The early gas furnaces used in Silesia, Sweden, and other European countries were but enlarged modifications of Geber's Tower of Athanor, and, although they were a great improvement on the furnaces in which solid fuel was burned on a grate, yet they were not able to produce a temperature sufficiently high and controllable to satisfy the demands of the rapidly developing iron and steel industries.

The gas furnace most commonly used in the American iron and steel works was invented about thirty years ago by the brothers Frederick and Charles William Siemens, German engineers resident in London. The first "Siemens furnace" built in this country under the sanction of these inventors was erected at the works of John A. Griswold & Co., at Troy, N. Y., in 1867, and was used as a "heating furnace."† This was followed in the

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* The first gas furnace of which we have any exact account was invented by Abu Musa Dschabir, more commonly known as Geber, an Arabian alchemist, who lived in the eighth century. The furnace invented by Geber he called the Tower of Athanor, or the *undying* one, because from its construction a steady and uniform heat could be maintained for an indefinite period.

† Previous to this, however, in 1862, there had been erected, at the copper-works of Park, McCurdy & Co., in Pittsburgh, a "Siemens furnace" for refining copper; and in 1864 Park Brothers & Co. (also of Pittsburgh) built one of these furnaces for heating steel; and in the same year, in a neighboring establishment (James B. Lyon & Co.) one was con-

same year by a heating furnace at the works of the Nashua Iron and Steel Company, Nashua, N. H., and early in 1868 the first "Siemens furnace" for melting steel in crucibles (often called a "pot furnace") was started in the works of Anderson & Woods at Pittsburgh.*

The first works in which the "Siemens gas furnaces" were used, to the exclusion of all other methods of burning fuel, were those of the American Silver Steel Company, at Bridgeport, Conn., which were erected from the plans and under the supervision of the author of these papers in 1868–'69. In these works were two puddling furnaces,† three heating furnaces, one twenty-four-pot melting furnace, a twenty-four-pot muffle, and ten "gas-producers," all on the Siemens principle. Gas from the "producers" was used under the boilers with entire success. At the time of the erection of these works they were the largest and most perfect plant of gas furnaces in America.

"Natural gas" has been known to the nations of the Old World for thousands of years. The Persian fire-worshipers used it for their sacred fire, and it has been used as a fuel in China since a time beyond the range of authentic history.

The earliest use of natural gas in this country was as an illuminant in the village of Fredonia, N. Y., in 1827, and it is still used there. The first person to use natural gas for manufacturing purposes is believed to have been Mr. William Tompkins, who, in 1842, employed it in the Kanawha Valley for heating the kettles of a "salt-block" one hundred feet in length. In 1845 Messrs. Dickerson and Shrewsbury bored a well on the Kanawha River, in West Virginia, to a depth of one thousand feet, from which a sufficient quantity of gas issued, according to a computation by Prof. B. Silliman, Jr., "to light the city of New York for twelve years." The first use of natural gas for the manufacture of iron was in the Siberian Rolling-Mill of Rogers & Burchfield, at Leechburg, Armstrong County, Pennsylvania, in 1874; twenty-nine years after it had been successfully used under a "salt-block" in West Virginia, and forty-seven years after its first use for light-

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structed for melting glass. None of these furnaces were built from the inventors' plans or under their license, and all were abandoned after a short life.

* All these furnaces, and many subsequently constructed, were built from the plans of J. Thorpe Potts, an English engineer, who was one of the firm of Richmond & Potts, representatives of the inventors in this country.

† These furnaces were the first successful gas puddling furnaces constructed, and although their performance was in every way satisfactory, and the works were visited by every prominent iron manufacturer in America, it was many years before puddling with gas became popular with the iron-masters of the country; in fact, it was not until the introduction of "natural gas" that the great value of gaseous fuel began to be properly appreciated, and even now there are new works for the manufacture of iron being erected, in which the puddling furnaces are not in any way better than those in common use in 1840.

ing at Fredonia, N. Y. But now gas wells increase and multiply in the land, and lines of pipe radiate from them in all directions, conveying silently as the lapse of time, to city and mill, forge and furnace, their heat-giving product that has lain dormant in the earth for untold centuries, but which now, at the summons of modern Science, comes forth from its abiding-place to do no small share of the work of the world. Many of these lines of pipe are of great length,* and suggest the possibility of converting coal into gas at the mines and conveying it to consumers in distant cities by pipes; and this proposal in our day is not nearly as uncertain of realization as was the original idea of lighting cities and buildings by gas at the time of its invention, one hundred years ago.

[*To be continued.*]

HYPOCRISY AS A SOCIAL ELEVATOR.

By JOHN McELROY.

WHEN atrabilarious Hamlet, in his choleric interview with his mother in the cabinet, impudently advised her to

"Assume a virtue if you have it not,"

he unwittingly laid down a general-conduct rule of high value to individuals and the community.

Simulation of virtue, though far inferior to the real article, is still the next best thing to it, just as whitewash, though much inferior to marble, is yet greatly superior to dirty nakedness.

It is very desirable that all men and all women should stand together on the very highest plane of goodness; but the largest proportion of them do not—probably never will. It is unreasonable to expect that the mass of humanity will be steadily aligned on the most advanced standards of morality, especially when those standards are pushed forward as rapidly as they have been in the more recent centuries. Ethics is a constantly developing science. What was a high grade of morality in the eighteenth century would be a very ordinary one to-day; just as the man who, in our colonial times, would have been regarded as neat and cleanly in his person, would seem a good deal of a sloven to-day. Then, as now, men and women assumed to be much cleaner, morally and physically, than they really were, and by sheer force of persistence and habit became really cleaner than they at first pretended to be. Persons with the bump of approbativeness highly developed constantly forge to the front on lines which they think will win

* One large mill has three lines of pipe, each over forty miles long.

them the esteem of their fellows, and the latter follow with unequal steps, first showing outward respect and conformity to better ideas and practices, and then making them more or less of realities in their lives.

Denunciation of hypocrisy forms a large part of the "properties" of lay and ecclesiastical moralists who exploit time-warped schemes of salvation. Exercise of moderate reasoning powers would teach them that calculating and persistent hypocrisy has been one of the most powerful factors in the moral advancement of the world. We all aspire higher than we attain, and in the moral domain pretense constantly precedes practice. We begin by appearing to be better than we really are, and the force of habit soon makes an actuality out of what was merely assumption. Hamlet explains this clearly to his mother:

> "That monster, Custom, who all sense doth eat
> Of habit's devil, is angel yet in this:
> That to the use of actions fair and good
> He likewise gives a frock or livery
> That aptly is put on. Refrain to-night,
> And that shall lend a kind of easiness
> To the next abstinence—the next more easy—
> For use can almost change the stamp of nature,
> And either quell the devil or throw him out
> With wondrous potency."

Those who pretend to be much better than they are have at least begun the upward development, and recognized the goal to which their faces should be turned.

No man is made worse by simulating goodness. There is every chance that he will be made better by the mere act of simulation.

Beyond doubt, the much-abused Pharisees were powerful promoters of the ethical development of the Jews. Their firm insistence upon higher moral ideas and purer lives could not have been without marked influence upon those around them. If the only motive for doing this was to enhance the esteem in which they were held by the community, it speaks well for their shrewdness in recognizing the drift of public sentiment, and for the community which honored superior goodness.

Jesus Christ's denunciations of them should be given the allowance usually accorded the polemic blasts of a sorely nagged sectary against his rival sectaries. If, indeed, they only cleaned the outside of the cup and platter, they certainly did much better than those who let both outside and inside remain foul. The very denunciation implies that this must have been the rule with those around them. If a man, seeking the applause of his neighbors, begins by furbishing the outside of his platter, in order to be superior to them, there is every probability that he will soon

progress to the cleansing of the inside also, so as to still keep ahead of those who emulate him by external purification of their culinary utensils. Then their cleanliness as a principle becomes merely a matter of time.

National histories and the portraiture of the great men of the past are all more or less flagrant pieces of hypocrisy. The historians of every nation carefully feed its self-esteem by the assiduous elaboration of everything in its past that is noble, brave, and enlightened, and the equally assiduous obscuration of all that is mean, cowardly, barbarous, and otherwise discreditable. It is true that modern historians have abandoned the ancient practice of tracing the descent of their peoples directly from the immortal gods, but they come as near it as the limitations of modern thought will allow. Invariably they represent their people as of exceptionally distinguished lineage and character and a powerful factor for good from the moment of entrance upon the stage of history. Its soldiers were godlike in courage and devotion; its statesmen divine in purity and wisdom. Higher motives than desire to flatter the national vanity help to actuate the historians in this misrepresentation. They believe that it is best to make out of the past ideals for coming generations to emulate. They desire to stimulate national virtue by high examples.

The truth is, the early history of every great nation is like the early history of men who have risen from the gutter to prominence. There has been a long and dreary period of ignorant—frequently disreputable—struggling of mean abilities, in mean ways, with mean competitors and mean surroundings. Rightly viewed, this is one of the most comforting facts in human history, for it shows that nations, like men, constantly

> "rise to higher things,
> With their dead selves as stepping-stones."

Take, for example, the history of England. The impression which has been studiously produced upon the mind of the average reader is that that great nation has, ever since the advent of William the Conqueror (if not before), occupied the same proud place at the head of the wealth, power, and civilization of the world that she has for the past century. Nothing could be farther from the truth for at least four centuries after the battle of Hastings. Until usurper Henry VII snatched the scepter from the lifeless hand of usurper Richard III, on Bosworth Field, in 1485, England was a thinly peopled, out-of-the-way island, of almost as little importance to the rest of the world as Venezuela is to-day. Such ignorant, dull, brutalized white men as the Englishmen of the Plantagenet period are not to be found to-day outside of a Russian village, or a community of Hungarian miners

in a Pennsylvania coal town. Then civilization shed but feeble light at its centers on the Continent, while the mongrel race in England were literally the "heathen of the isles," who dwelt in Cimmerian darkness. Nor, as historians would make us believe, was the high civilization which succeeded self-evolved from this unpromising horde. Native Englishmen—Norman and Saxon—played but a small part in the development of the nation. The men who made England were the swarming adventurers from every land—enterprising merchants, cunning artificers, and sailors bold—who flocked to the island when the discovery of the Cape of Good Hope and the Americas, together with the growth of northwestern Europe, made it the finest business location in the world. It gratifies the pride of the amalgamated descendants of those many-tongued adventurers to believe that they are sprung directly from the Anglo-Saxon lords of the soil, or from the "landless resolutes" who went filibustering with William the Bastard. The besotted peasantry found to-day in the purely agricultural districts of England indicate the intellectual sterility of the land before its splendid commercial opportunities caused it to be fertilized by a freshet of the best brains and energy of the Continent. The domestic peace which began with the Tudors was also potent in this enrichment, in attracting thither from the war-accursed mainland a large share of the intellect and skill of Europe. The few hundred thousand beef-witted Britons of the days of the early Tudors would have counted for no more in history than the Bretons of France, the Basques, or the Styrians, had it not been for the inundation of superior minds, moved to flow in from every quarter by love of gain, of peace, and of freedom of conscience.

"Lives of great men all remind us," if we examine them critically, that, since their day, the advance in morals has been almost as great as in the arts and sciences. Judged by present ethical standards, many great men of the past—the benefactors of their race, and men who builded strongly and well for their countries and the world—had the morals of the slums. Had they been held to the same accountability as the men of to-day, they would have been social outcasts, if not actually behind prison-bars.

Taking even our own country, and so recent history as that of the end of the last century, every well-informed man knows that the private lives and much of the public careers of the men whom we revere—such men as Winthrop, Hancock, Adams, Washington, Jefferson, Madison, Franklin, Monroe, Jackson, etc.—would not bear at all the tests we now apply to public and private characters. Yet we hypocritically assume that these men were altogether superior to any now before the public eye. We teach our children that they were ideal men, whose characters form the highest

models for imitation. While this is arrant hypocrisy, it is probably wise public policy, and, after all, but justice to those illustrious men. Their morals were undoubtedly superior to the rule in their day. The good they did lives after them, while the evil is buried with their bones. Much, too, of the evil seemed good to them. As Froude well says, "All history is anachronism, for we constantly see the events of yesterday by the light of to-day." Nothing is to be gained by parading their weaknesses and vices, while much good is accomplished by presenting them as unblemished ideals—exemplars for present and future generations.

It is the same with our national history. Up to that time there was never a more genuinely patriotic struggle in the history of the world than our Revolution. Yet if the movement for independence had been deprived of all the aid given it by sordid greed, selfish ambition, industrious self-seeking, and partisan rancor, the patriotic impulse would have been far from strong enough to carry on the contest to final victory. But we wisely enrich human nature by placing to its credit all these baser metals transmuted into the pure gold of unselfish patriotism.

The elevation of woman to her present position from the degradation into which she had sunk during the long night of the dark ages was a slow and tedious work. Nothing aided in it so much as the arrant hypocrisy which took the form of mediæval gallantry. It became the fashion to show ostentatious deference to woman, especially if she had birth, youth, and some pretensions to beauty. At first hollow and specious to the last degree—thinly varnishing a bestiality so low that it was scarcely above that of a "bull" seal, who takes possession of all the "cows" that he can force into his rocky harem and defend against the lust of rival "bulls"—the bombast of idolatrous devotion, the shamming of respectful deference, the make-believe admission of superiority in manners, morals, love, and religion constantly came, by mere force of iteration, to approach nearer the reality. Even the coarsest-grained of the gluttonous and swilling boors who formed the body of the "gentle knighthood" became, through the habitual wearing of the mask, more genuinely appreciative of womanhood and more of a gentleman at heart. The women, on the other hand, for the same reason, became more elevated because of the factitious elevation assigned them, better informed as to what was due them, and more strenuous in exacting it.

Sir De Bracy, the "free captain," was quite capable, had he gained the Princess Rowena for his wife, of beating her "with a stick no larger than his thumb," as the old English law permitted, or of subjecting her to other and deeper indignities. But the requirement of ostentatious politeness in public would have oper-

ated to make him less of a tyrant at home, and this influence, extending through scores of generations, has assisted powerfully in securing for women all that they now enjoy. Even the Ivanhoes of the thirteenth century made fearfully tough husbands, and led their "queens of love and beauty" wretched lives; but still they had to make some show of living up to the gush and swagger of the tournament, and the women were better off than they otherwise would have been.

Millions have drifted into intimate relations with the bath-tub and clean linen who, at the outset, had no intention of going further than such superficial cleansing as would make a good impression on those around them whose favorable opinion it was desirable to have.

The traditional young lady who, notified that she was to go to a party that evening, called down the stairs to her mother to know if she were to wash for a high-necked or a low-necked dress, undoubtedly came in time to value cleanliness for its own sake, and make her ablutions without careful reference to the amount of surface her costume would reveal.

We shall go far, however, to find so good an illustration of the rapid development of pretense into actuality as is afforded by the history of religions. All religions began with shows, forms, and external observances, which, *per opere operato*, as the Catholics used to hold of baptism, speedily became faith. The conquerors, rulers, and soldiers who, for political and selfish reasons, imposed the Christian and Mohammedan religions on more than half the world, only attempted to compel extrinsic acceptance of their forms and ceremonies. What one generation did under the shadow of a sword which was quick to smite, succeeding ones did from what was considered the deepest religious instincts. Outward forms, which were terms of capitulation exacted by conquerors, quickly grew into symbols of true inward faith. Belief sprang from the reflex action of acts. Men did certain things to save their lives or property, and then fully accepted the spiritual meaning of those things. So long as Christianity relied merely on the teaching of its doctrines, it made slow progress indeed. Three centuries after Christ Constantine the Great, for political reasons, gave to it the powerful aid of the sword of state, and thereafter its spread was much more rapid. Still, it required more than one thousand years of bloody propaganda, by blade and fire, before its ascendency became acknowledged throughout the whole of Europe. By the end of the fourth century the energetic militarism of Theodosius the Great—frequently exerted by armies of barbarians—had nominally overthrown paganism throughout the Roman Empire, and nominally established not only Christianity, but the Nicene form of that faith. His successors devoted such

leisure intervals as they could gain amid their swiftly following intrigues, accessions, assassinations, insurrections, invasions, and dethronements, to wholesale baptisms of Jews, pagans, and other non-Christians, so that the Church grew in numbers though the empire fell to pieces.

In the eighth century Charlemagne set about the work of evangelization on a grand scale, and for thirty-two years devoted the major part of the military resources of his empire to spreading the gospel among the heathen Saxons. He killed off possibly one hundred thousand of them—slaying forty-five hundred in cold blood at one time—and deported thousands of those he did not kill to other lands. Finally, their king and leading warriors had to bow before his puissant sword, and receive the rite of baptism. He also converted great numbers of Huns, Danes, Wends, Swedes, and Czechs.

Still a large portion of northern Europe was left under the control of the priests of Odin, and for several centuries the work of rounding up these pagans, and chasing them with blade and brand into the bosom of the Church, was a favorite occupation of princes and knights. At the end of the tenth century Olaf I succeeded in converting the Norwegians at the point of the lance, and his son followed up pagan-killing with such enthusiasm as to win himself canonization from the Church. Sweden was brought into the fold about the same time and by the same means; but it was not until the beginning of the thirteenth century that the Christianization of Denmark was completed by a grand raid of Valdemar II into Esthonia. Then the Teutonic Knights did some very successful missionary work, accompanied with much slaughter, in securing the supremacy of the Cross among the heathen of Prussia, Courland, and Livonia.

While mailed hands were thus persistently hammering the heathen of northern Europe into practicing Christian rites, the evangelization of Russia was brought about with less attrition—the Muscovites being a more submissive people. Toward the end of the tenth century Vladimir the Great decided that it was necessary to have a state religion. He studied the Jewish, Mohammedan, Roman Catholic, and Greek forms, and gave the preference to the latter. He had sixty thousand of his people baptized in one day, and the rest accepted the ordinance as fast as his agents could reach them and communicate his will.

Everywhere the result was the same. Outward compliance begat inward conviction, and the peoples whose stubborn necks were bent with most difficulty to the yoke of the Church became in time its sturdiest upholders. Hudibras says:

> "The man enforced against his will
> Is of the same opinion still."

Human history does not confirm this. On the other hand, it supports the assertion that if the enforcement is strong and continuous, the probability is that the enforced one's opinion will eventually coincide with it. With several volumes of standard reference books close at hand, I calmly await the vehement chorus of dissent from this proposition.

CULTIVATION OF SISAL IN THE BAHAMAS.

By JOHN I. NORTHROP,
OF COLUMBIA COLLEGE.

"ARE you interested in sisal? What do you think of it?" These were the questions addressed to the writer almost before he had landed in the Bahamas. The object of the writer's visit to the "land of the pink pearl" was to make a collection of its plants and animals; but, during the pleasant six months occupied in so doing, he had many opportunities of observing the cultivation of the "sisal hemp." This industry is now in its infancy in the Bahamas, but, if the present prospects are realized, it will before long bring to the islands both wealth and prosperity. Since his return the writer has found that most of those to whom he has spoken of sisal had at best but a vague idea of the fiber or of the plant that produces it, so it was thought that some notes on the subject might prove of interest.

The group of coral islands known as the Bahamas lies east of southern Florida and north of Cuba. One of the islands, New Providence, is well known to those who, in search of health or recreation, have been to Nassau and enjoyed its lovely winter climate. But the "out islands," as the remaining ones are locally termed, are seldom visited, even by those who live in Nassau. The largest of these "out islands" is Andros, which is about the size of Long Island, New York; there, as in all the others of the group, except New Providence, the population is almost entirely composed of negroes, only seven white men living on the island; and of these, four are interested in the production of the fiber known as sisal hemp.

The term "fiber" is used commercially to designate the material obtained from the leaves or stems of many different plants. Hemp, on the contrary, refers to the product of a single plant, known botanically as *Cannabis sativa*, and belonging to the same order as our hop. But in speaking of fibers the word "hemp" is often added, and thus we hear of "sisal hemp," or, as it is sometimes called, "sisal *grass*," or even manila. The latter term, however, is properly restricted to the fiber obtained from a species

of plantain (*Musa textilis*), belonging to the same genus as the banana.

Sisal hemp, the subject of this paper, is obtained from the leaves of some of the species and varieties of the genus *Agave*, one species of which is well known in cultivation under the name of "century plant." This genus belongs to the order *Amaryllidaceæ*, and is related to the snow-drop, amaryllis, and narcissus; but, owing to the much greater size of the plants, and some peculiar points of structure, it stands prominent among its congeners. The agaves are indigenous in the New World only, and the majority of the species are natives of Mexico, only a few being known within the limits of the United States.

The same general appearance is presented by all, so that any one familiar with the century plant can form a very good idea of the appearance of the other species of the genus. In all, the leaves are thick and fleshy, as they contain the supply of material which is to nourish the great flower-stem when the plant arrives at maturity. This stem, which is a prolongation of the trunk of the plant, shoots up from the center of the rosette of leaves, and often attains a height of from twenty to thirty feet. The time required to arrive at maturity varies in the different species, and in the same species under different conditions. The "century plant" in its native home, Mexico, blossoms in from ten to fifteen years, while with us it requires thirty, fifty, or in some cases, it is said, even a hundred years to mature. During the production of the great flower-stalk the store of nourishment in the massive leaves is exhausted, and, after the fruit is produced, the plant withers and dies.

The leaves of all the agaves contain what are known botanically as the fibro-vascular bundles. In order to see these, it is only necessary to cut off a leaf of the century plant; as, in a thick transverse section, that has been allowed to dry slightly, the fibers will look like short bristles projecting from the surrounding soft tissue; and in a longitudinal section these bristly points are seen as threads running through the leaf. Should the observer be the fortunate possessor of a compound microscope, on examining these threads he will find them composed of exceedingly fine, elongated cells, closely connected in a bundle, and surrounded by the much larger circular cells that compose the soft parts of the leaf. When the outer skin and the soft tissue of the leaf are removed, the fibro-vascular bundles remain and constitute what is commercially known as "fiber."

While all the agaves will yield fiber of some kind, it is only in a few that the quantity and quality of the material are such as to make its manufacture profitable. This fact has been known for a long time in Yucatan, the home of the sisal industry. There

the natives have from time immemorial cultivated a number of agaves, until now it is difficult for botanists to decide whether some of them are distinct species or only cultivated varieties.

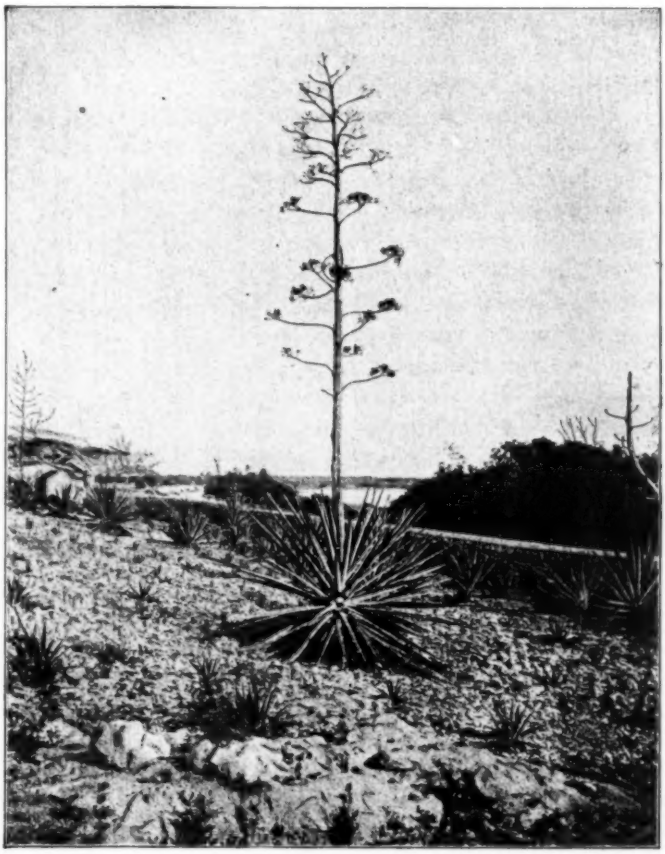
One of the native species, known as *Agave rigida*, is a rather small plant, having leaves from two to four feet long, and as many inches wide. These are armed on the edges with dark-brown spiny teeth, and are terminated by a stout, reddish-brown spine. This seems to be the plant called *chelem* by the natives of Yucatan, and is the one from which the cultivated varieties are supposed to have originated. These varieties, collectively known as *henequen* or *jenequen*, are separately distinguished as the "*yaxci*, furnishing the best quality, and the *sacci*, with the largest quantity of fiber; *chucumci*, larger than the last, produces coarse fiber; and *babci* has finer fiber, but in smaller quantity."

Of the varieties mentioned above, only two need be considered—the *sacci* and the *yaxci*. The former, known as *Agave rigida*, variety *longifolia*, is distinguished from the native plant by having much longer, spiny leaves, from four to six feet in length, and slightly different flowers. It is extensively cultivated in Yucatan, and, as already stated, yields the most fiber. The other variety, the *yaxci*, botanically dignified by the title *Agave rigida*, variety *sisalana*, or sometimes even elevated to the rank of a species, is one of the most valuable of the fiber-producing agaves.

The leaves are of a dull-green color, four to six feet long, as many inches wide, and terminated by a stout, dark spine. The margins are commonly described as smooth, as they are without teeth, but in all the plants examined by the writer the leaves were slightly rough on the edges, and in many of the young plants some of the leaves had well-developed teeth. A full-grown plant presents a rather striking appearance, bristling all over with the long, spiny-tipped leaves, thickly radiating from the short cylindrical trunk, which is crowned by a sharp, slender, cone-like bud. Indeed, a large plant makes one think of a gigantic sea-urchin. The leaves as they unfold from the bud slowly assume a horizontal position, but remain rigid and straight, never curving downward, as they do in the century plant.

As has been said above, when the plant arrives at maturity, and has a sufficient store of nourishment, it sends up its flower-stem, known to cultivators as the "mast" or "pole." This is from twenty to twenty-five feet high, and about six inches in diameter near the base. On the upper two thirds branches are developed, converting the pole into a huge panicle, covered with innumerable greenish-yellow flowers. A peculiarity of the sisal plant is that it seldom or never sets a seed. The flowers fall, carrying the ovary with them, then on the ends of the branches

young plants develop, so that the pole presents a rather odd appearance, with the small plants growing out in the places usually occupied by the flowers. When these young plants have attained a height of from three to four inches, they fall to the ground and take root. The old plants also reproduce themselves by means of suckers, and hence, when old and neglected, are often seen surrounded by numerous smaller ones, as in the common houseleek (*Sempervivum*).

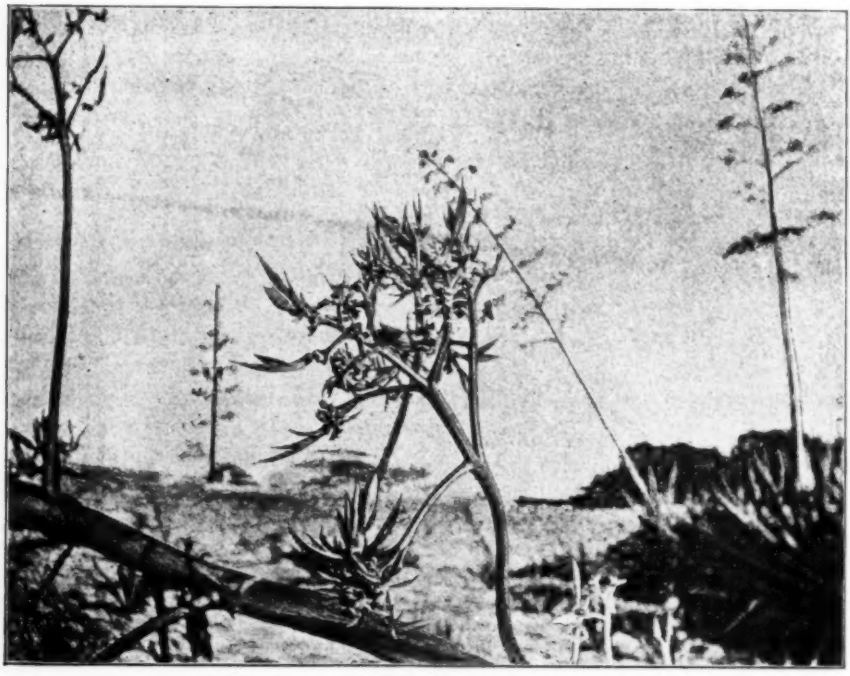


Agave rigida, VAR. *sisalana*, IN BLOSSOM, NEAR NASSAU, N. P.

Such is briefly a general description of the plant that seems destined to occupy the capital and energies of the people of the Bahamas; for it was this plant that was introduced there a few years ago by Sir Henry Blake,* then governor of the colony.

* Governor Blake is generally credited with having introduced the plants. But as early as 1854 an agave was sent by the British vice-consul Baldwin from Florida to the Bahamas. It is not unlikely that this plant was the same as those introduced by Dr. Perrine into Florida.

Although the plants were neglected, they throve and increased to such an extent that finally the people looked upon them as troublesome weeds, and as such they were often destroyed. Their usefulness, however, was evidently appreciated by a few; for, as Sir Ambrose Shea, the present Governor of the Bahamas,



A BRANCH OF THE "POLE" OF THE SISAL PLANT.

told the writer, he was one day passing the house of a native, when a piece of rope attracted his attention. On inquiring where he obtained it, the negro replied that "it growed in de yard," and showed the governor the plant, and explained the way in which the rope had been made. Now, Sir Ambrose happened to be a native of Newfoundland, and hence knew a good rope when he saw it; so inquiries were at once made, and the value of the plants was learned.

The people, however, were slow to realize the importance of the subject, but the governor evinced great energy and enthusiasm in keeping it before them, and when some of the fiber obtained from old plants sold in London at the rate of fifty pounds per ton, and was declared to be superior to that produced in Yucatan, sisal in the Bahamas had somewhat of a "boom," and people carefully guarded the very plants that formerly they would have destroyed as weeds. Everybody became enthusiastic, and sisal plantations were everywhere started, not only by the

people of the colony, but also by outsiders, as the following facts show.

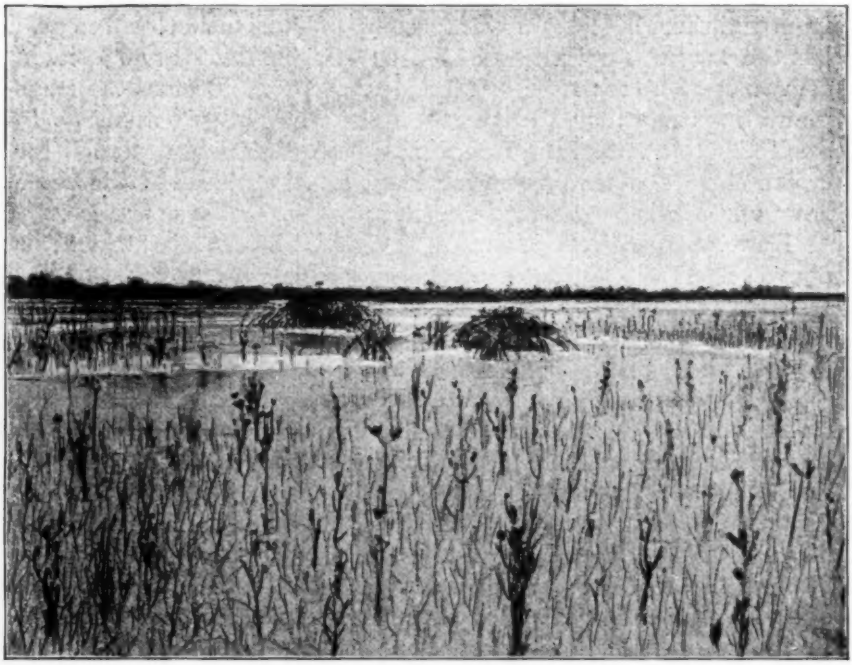
A company from St. John's, Newfoundland, has obtained a grant of 18,000 acres of crown land at Abaco; another tract of 20,000 acres on the same island has been allotted to a London company; 2,000 acres have been taken on Andros by a gentleman from Edinburgh; 1,200 are in process of cultivation on Inagua; but the largest application has been lately made by two London companies, who together ask for 200,000 acres. Besides the large plantations mentioned above, many small scattered areas go to swell the total. Indeed, there have been so many demands for crown land, that the governor has recently advanced the price from one dollar and twenty-five cents to four dollars per acre.

Now as to the character of the land. In Andros, which, as above stated, is the largest of the group, and where most of the writer's time was passed, the land is locally described by one of three terms: it is either "coppet," "pine-yard," or "swash." The coppet, which occupies, as a rule, the more elevated parts of the island, is composed of small angiospermous trees, often only two or three inches in diameter, and so close together as to make an almost impassable thicket. Back of the coppet, which is mostly a fringe along the eastern coast, nearly the whole interior is one vast "pine-yard," made up of the Bahama pine (*Pinus bahamensis*). The trees are generally small, and from ten to twenty feet apart. Under them is very frequently a dense undergrowth of a tall brake, which is often six or seven feet high, and is known by the natives as "May-pole."

"Swash" is a very expressive term to denote the low, swampy ground, of which there are thousands of acres on the west coast. Here the soil is soft and is composed of comminuted calcareous particles; it supports no vegetation except innumerable small mangroves (*Rhizophora mangle*), here and there small "button-woods" (*Conocarpus erectus*), a few "salt bushes" (*Avicennia nitida*), and in some places palmettoes. So far as sisal cultivation is concerned, the "swash" is utterly valueless; but the "pine-yard" and coppet are both available. In neither of these, however, is there what we recognize here as "soil"; and at first it was a source of wonder to the writer that anything at all could grow there, for the surface is very largely the bare coral rock. However, it is rarely smooth, but is rough and jagged with innumerable points and crevices, so as to resemble somewhat the appearance of a well-thawed mass of snow-ice. In most places, also, there are numerous holes, from a few inches to many feet in diameter; and it is in these holes, cracks, and crevices that what little earth there is can be found—still, this little seems sufficient to support the dense vegetation. Some of the other

islands—Eleuthera, for instance—have considerable depth of soil; but it is when growing on the bare, rocky ground described above that the sisal is said to produce fiber of the best quality.

Given the land, the next step is to clear it, and the method of clearing varies according to the character of the vegetation. If



"SWASH," WEST SIDE OF ANDROS.

it is "pine-yard," a fire is started, which burns off the May-pole; the pines are then cut down, and either made into charcoal or laid in rows across the fields and allowed to decay; if coppet, the trees and shrubs are cut down with axes or cutlasses, according to their size, and the brush is then burned.

While his land is being cleared, the planter should be getting his plants ready. As usually obtained, they are fresh from the "pole," and only from one to four inches in height. These are too small to put out in the fields, so they are set out in beds of cave earth until they get to be eight or ten inches high. When taken from these nurseries their rootlets are carefully trimmed off, and they are then planted every eight or nine feet in rows that are about ten feet apart. Thus an acre of ground usually contains from five to six hundred plants. In order to facilitate carrying the leaves out of the field, the latter is divided by roads into sections of about one hundred acres each.

After planting, it is not very long before the fields will have

to be weeded, and this process is said to be necessary about twice a year, until the sisal plants attain a height of three or four feet, when weeding is no longer needed. The most troublesome enemy of the planter, in the way of weeds, is the "May-pole," as it grows very rapidly, but the roots are said to die after the third cutting. In about four years the sisal plant produces what are called "ripe leaves"—that is, leaves that are horizontal and large

CLEARING THE "PINE-YARD" FOR SISAL NEAR NASSAU, N. P.

enough to cut. The cares of the cultivator are now about over, and all he has to do is to cut off the leaves as fast as they mature, and manufacture his fiber.

The cultivation of sisal is of such recent introduction into the Bahamas that as yet none of the large plantations have begun to produce to any extent; so for a description of the next stages we will turn to Yucatan, where, as has been said, the industry has been carried on from time immemorial. There the men cut the leaves off close to the trunk, and lay them tip to butt in bundles of fifty, when they are carted to the machines. The cutting of thirty bundles, or fifteen hundred leaves, is considered a good day's work. In order to save the cost of transportation, as the leaves yield but about five per cent of fiber, there is usually a machine to every one hundred acres. The machine now in use consists of a horizontal wheel, on the face of which brass strips are

transversely placed, forming dull knives. The leaf is introduced so as to bring one side in contact with the revolving wheel, which is run by a small engine. A brake then presses the leaf against the scrapers, while the butt is firmly held by a pair of pincers. The scrapers remove the outer surface and some of the soft tissue; then the leaf is taken out and turned, and the other side undergoes the same operation, until only the fibers are left. These are then shaken out and hung in the sun for a few hours to dry. The result is a rather coarse fiber of considerable strength. The finest quality is nearly white, while the inferior grades are yellowish in color. In order to produce the best quality of fiber, the leaves must be cleaned as soon as possible after being cut; otherwise the fiber is apt to be spotted.

It may be well to state here that the cultivation of sisal is also being tried in Bermuda, Trinidad, and Jamaica, but on a much smaller scale than in the Bahamas. There, as already stated, large tracts of land have been bought from the Government for the sole purpose of producing the sisal hemp. The price is now four dollars an acre, and two acres are said to produce one ton of fiber. Wages for men vary from thirty-six to sixty cents per day, according to the season and locality, as most of the negroes are spongers, and at certain times of the year labor is not easy to obtain. Women, however, are largely employed in the planting and weeding, and receive on the average twenty-five cents a day. These are the data on which it is stated that a ton of fiber can be produced for fifty dollars. As the price of the fiber is now from one hundred and twenty to one hundred and thirty dollars a ton, and has been as high as two hundred dollars, these figures look attractive.

But it may well be asked, "How about the quantity of fiber now on the market, and will the market stand the enormous increase, that the yield of the Bahamas will give?" That is, of course the very point on which the question of profit or loss will turn. The writer has been told, by one who is well acquainted with the fiber market, that if the sisal hemp could be sold for four and a half or five and a half cents per pound, in a few years the consumption would be doubled; for, when the price reaches nine or ten cents a pound, the use of the fiber for many purposes is abandoned, and is replaced by some cheaper material, as jute.

One of the principal obstacles in the way of cheaper fiber is the need of a good machine, as the one now in use is a crude affair, requiring the attendance of two men and a boy besides the engineer, and producing but a small quantity of fiber daily. Although much skill and money have already been spent in attempting to invent a better machine, as yet all efforts have been unsuccessful; but, as inventors and mechanics are still at work,

and as the recent "sisal boom" in the Bahamas will increase the demand, there is little doubt but that here, as in so many other cases, necessity will prove the mother of invention. When the fiber can be cheaply produced in large quantities, there is little doubt but that increased uses will be found for it, and that the demand will equal the supply.

THE HOUSE OF A SISAL PLANTER, ANDROS.

In 1887 Yucatan exported crude fiber valued at over $3,000,000, besides $37,862 in rope and $43,891 in hammocks. About eighty-four per cent of the crude fiber and fifty per cent of the hammocks came to the United States; most of the remaining fiber went to England, Germany, and France, while Spain took the rest of the hammocks and all the rope. In 1889 the import of sisal hemp into the United States was between $6,000,000 and $7,000,000, about 50,000 tons, on which a duty of fifteen dollars a ton was paid.*

Now it may be asked, "Why can not the United States produce sisal too? Is no portion of our vast territory suitable for this crop?" As we shall see, some one *did* ask that question over fifty years ago. It is not generally known that in 1827 the Treasury Department issued a circular to some of the American consuls, requesting them to collect and preserve seeds and specimens of

* The duty has since been removed.

such plants in their districts as were "useful as food for man or the domestic animals, or for purposes connected with the manufactures or any of the useful arts." The American consul at Campeche, Dr. Henry Perrine, responded to this call with energy and enthusiasm, and soon introduced into Congress "a bill to encourage the introduction and promote the cultivation of tropical plants in Florida, and conveying to Dr. Perrine and his associates a township of land, on condition that every section should be forfeited if at least one fourth thereof should not be occupied and successfully cultivated in tropical or other plants within five years." These hard conditions were accepted by Dr. Perrine, and in one of his letters to Congress he calls attention to the sisal plant, and says, "He repeats his unbroken conviction that its introduction will make an era of as great importance to the agricultural prosperity of our confederation as the invention of the cotton-gin."

For nearly ten years he labored, sending to Florida plants and seeds, and endeavoring to obtain his township of land, desiring "no more honor than the power of passing the brief term of his painful existence amid the privations and exposure incident to a chief pioneer in the planting and population of tropical Florida." He finally succeeded in establishing a sisal plantation on Indian Cay. Unfortunately, Dr. Perrine was not permitted to see the result of his labors, for, during the Seminole War, the Indians set fire to his buildings, and he himself fell a victim to their merciless attack. With the death of Dr. Perrine ended the cultivation of the plants he had introduced; but one of them, that he named *Agave sisalana*, remained, became naturalized, and is now flourishing on some of the Florida Keys, where the young plants are now being gathered and carried to the Bahamas.

Thus we see that the plants are growing within our borders, and it is only necessary to determine the quality of their fiber; for, although the plants are the same species as those now cultivated in Yucatan and the Bahamas, the quality of the fiber may not be as good, and yet on the other hand it may be better. For instance, it is said that the Bahama fiber is superior to that produced in Yucatan; so why may not the "Florida fiber" of the future surpass that of the Bahamas? In order to determine its value it is only necessary to prepare it by hand from the plants now growing in Florida and compare it with the article now on the market. The subject is being investigated by the Department of Agriculture, and a report may be looked for in the near future.

It may be said in conclusion that, as a crop, sisal has much to recommend it. It grows best on barren, rocky land that is useless for other agricultural purposes. Drought affects it but little, if at all, as the writer can testify from his own observation. The yield is not confined to any one season, but is continual; hence

the employment of labor is constant, and the planter can estimate closely what the yield will be for a given time. The old plants are easily replaced by the suckers that have been previously cut off and kept for this purpose. These advantages are shared by all the cultivators of sisal; but, in addition, the planter in Florida will have at his door a market that now absorbs eighty-four per cent of all the fiber produced. He will not only bring into use land now almost worthless, but will probably make for himself a fortune and introduce a new industry into the United States.

DR. KOCH'S METHOD OF TREATING CONSUMPTION.*

By G. A. HERON, M. D., F. R. C. P.

GENTLEMEN: This demonstration is given at the request of my friend Dr. Koch, who desires that in London and elsewhere his method of treating tuberculosis should, so far as is at present practicable, be open to the inspection of the medical profession. Certain parts of this work are already established upon a basis of clinical observation. Other parts of it remain still to be worked out. I think practically all that is yet known to be of consequence in the work is stated in Dr. Koch's paper, which was published in Berlin on the 14th of last month—a paper which has excited more wide-spread interest than any other contribution to medical literature. As a matter of course, you are all familiar with the details of the paper, and I propose to do no more to-night than to touch briefly upon those parts of it which it seems to me are essential to the understanding of the method of the administration of the remedy to our patients, and to a clear apprehension of the obvious results which follow its use in human beings.

The mode of action of the remedy within the body is not yet fully known. This much, however, is certain: tubercle bacilli are not destroyed by it in the tissues. It is upon the living tubercular tissues encircling the tubercle bacilli that the remedy produces its effect, and Koch says of this action that there is, "as is shown by the visible swelling and redness, considerable disturbance of the circulation and, evidently in connection therewith, deeply seated changes in nutrition, which cause the tissue to die off more or less quickly and deeply, according to the extent of the action of the remedy.... To recapitulate," he goes on to say, "the remedy does not kill the tubercle bacilli, but the tubercular tissue; and this gives us clearly and definitely the limit that bounds the action of the remedy. It can only influence living tuberculous

* Address delivered at the City of London Hospital for Diseases of the Chest, December 1, 1890.

tissue; it has no effect on dead tissue, as, for instance, necrotic cheesy masses, necrotic bones, etc., nor has it any effect on tissue made necrotic by the remedy itself."

In dead tubercular tissue living tubercle bacilli are often found. If the organisms so situated do not escape in some way from the body, they may find a nest for themselves there, and so set up fresh centers of tubercular disease. This fact clearly indicates that the treatment of tuberculosis by this new remedy must be continued for some time. From what is now known, it seems likely that about six weeks will be required to rid patients in the early stage of consumption of the symptoms of their disease. Whether this does or does not mean the complete cure of the disease is at present a question which will be answered conclusively by patients treated in hospital wards. It is in the highest degree probable, as every bacteriologist will understand, that relapses will occur. They must be treated on the principles already laid down by Koch, and their importance as a factor in the ending of the case must be worked out in public hospital practice. This I can say concerning the success which attends the use of this remedy in tuberculosis. I have never seen in a considerable series of cases treated by any remedy such uniformly good results, nor results so favorable to the patients. I do not, in what I have just said, include cases of advanced lung tubercle. Of that class of patients I have seen too few treated in the new way to entitle me to speak of them from my own knowledge. What we have heard and read of such cases in connection with this treatment leads us to expect at most temporary amelioration of their condition. Attention can not be too forcibly drawn to what Koch says, in his paper of November 14th, concerning the grave responsibility which will in future rest upon medical men, who leave any means untried to diagnose tubercular disease in its earliest stages. To that end the examination of the sputum ought, he says, to be much more frequently practiced than it is to-day in Germany. Speaking from an experience in that direction which is not small, I venture to say that this remark of Koch's applies with at least quite as much truth to England as to Germany. Now that we have the means, in this new remedy, of holding out to our patients who are in the early stages of tuberculosis—whatever form the disease may assume—the highest probability of a cure of their condition, it will, in my opinion, be a very grave reproach to any medical man who neglects to make an early diagnosis of tuberculosis, and, having done so, postpones needlessly the systematic use in those cases of Koch's remedy.

Koch has said that the action of his remedy consists in the destruction of living tubercular tissue. The destroyed tissue must be thrown off or absorbed. We might, perhaps, feel un-

easy as to the consequences of this, even in some cases of lung tubercle in its early stages, and especially in tubercle affecting the larynx, where the swelling, which is part of the effect of the remedy, might conceivably prove dangerous. Experience has, however, shown that, in the considerable number of such cases already treated, no serious risk has arisen. It is a fact that the mucous membranes of the tubercular larynx, while under this treatment, do not swell to such an extent as to interfere very seriously with respiration. Even in advanced cases of lung tubercle, with excavation of considerable portions of lung tissue, there have been no ill effects from the treatment when it has been conducted with careful attention to the regulation of the dose of the remedy.

The remedy is a transparent, reddish-brown fluid, not unlike brown sherry in appearance. It has no sediment, and when undiluted does not readily decompose. When diluted with distilled water it is, on the contrary, apt to decompose. Bacterial growths quickly appear in it, and it becomes turbid. In this condition it is unfit for use. Its decomposition in dilution is prevented by boiling it, but that process is not necessary if the dilution be made with a half-per-cent solution of carbolic acid in distilled water. It should be remembered that both by the frequent boiling of the dilution, as well as by the mixing of it with carbolic acid in the way described, the vigor of action of the remedy is impaired, and therefore fresh dilutions ought only to be used. Experience has, however, shown, I am told, that a one-per-cent dilution of the remedy made with distilled water containing one half per cent of carbolic acid remains efficient at the end of one week. The remedy is introduced into the body subcutaneously by means of a syringe which Koch devised for his bacteriological work. It has no piston or washers, and consists of four parts—an India-rubber ball, with a small hole in it. This ball is fixed upon a hollow metal stem furnished with a stopcock; into the other end of the metal stem there fits a glass tube, pointed at the farther end, and graduated to one cubic centimetre, each division representing a milligramme. Upon the pointed end of the glass tube there fits a hollow needle. In using this syringe the glass tube, with the needle affixed, is detached from the metal stem and filled with absolute alcohol. The metal stem and ball are then replaced in position, and the alcohol gently expelled. Every day before using the syringe I think it well to disinfect the metal stem and the India-rubber ball. Alcohol, however, causes cloudiness in the dilutions of the remedy, and therefore it is necessary to get rid of it as much as possible. For that purpose I wash out the syringe with a little distilled water.

The dose of the remedy has been sufficiently well fixed for

all practical purposes. In a healthy man, 0·25 c. c. produces an intense effect. Koch thus describes the symptoms produced by that dose on himself, after it had been injected into his upper arm: "Three to four hours after the injection there came on pain in the limbs, fatigue, inclination to cough, difficulty in breathing, which speedily increased. In the fifth hour an unusually violent attack of shivering followed, which lasted almost an hour. At the same time there were sickness, vomiting, and rise of body temperature up to 39·6° C. (103·3° Fahr.). After twelve hours all these symptoms abated; the temperature fell until next day it was normal, and a feeling of fatigue and pain in the limbs continued for a few days, and for exactly the same period of time the site of injection remained slightly painful and red."

One c. c. of a one-per-cent solution—that is to say, a dose of 0·01 c. c. of the remedy—is the smallest dose which affects healthy adults, and the symptoms, more or less marked, following its administration are, in the majority of cases, slight pain in the limbs and a sense of transient fatigue. Only a few persons after this dose show a rise of temperature up to not more than about 100° Fahr. The word "reaction" is used to indicate the symptoms, mild or severe, which follow upon the use of the remedy. In non-tuberculous adults there is no real reaction consequent upon the administration of any dose of the remedy less in amount than 0·01 c. c.; therefore, the presence of reaction in the adult after a dose of less than 0·01 c. c. of the remedy shows the presence of tubercle in the patient. If in the adult no reaction were obtained by any dose short of 0·01 c. c., then it would be certain that the case in question was not one of tuberculosis. This is a law to which no exception has hitherto been found, and it gives the remedy great diagnostic value, which, it seems likely, will be one of its most useful clinical applications. The law applies to both man and beast, and to all tubercular conditions. Already cases have occurred in which the presence of tuberculosis was not even suspected until the remedy was injected and reaction followed.

The dose of the remedy is regulated in tubercular cases by the age and strength of the patient, and by the conditions of his disease. In children and weak people, and in cases of very extensive disease of the lungs, the treatment should begin with the smallest effective dose, which should be very gradually increased. In fairly strong adults with lupus, joint or gland disease, and also in cases of lung tubercle, where the disease is slight in extent, or where the case is doubtful, a full dose of 0·01 c. c. may be administered with safety. But in lung disease, however slight or otherwise favorable the case may be, it is well to begin with a much lower dose. The difference in the conduct of the treatment of

lung tubercle and of lupus is that the former is treated with small doses daily, and the latter with large doses at intervals of one or two weeks. Tuberculosis of joints, bones, and glands is treated in the same way as lupus.

A first dose in early cases of lung tubercle in an adult should be either 0·001 c. c. or 0·002 c. c. If reaction follows this dose, then it should be repeated after the temperature has returned to the normal point. The same dose should be continued in this way until no reaction follows its use. The dose should then be increased by one, or at most two, milligrammes at a time; each dose being repeated until it is found that no reaction follows its administration, and so on until the dose of 0·01 c. c. is reached. The dose of the remedy should never exceed 0·01 c. c., except as a test to ascertain whether the utmost limit of benefit to the patient has been secured, and this test should be applied to every case. The duration of the treatment in early cases of lung tubercle Koch states to be, as I have already said, from four to six weeks. If after the administration of test doses of the remedy no evidence of the presence of disease is noticed, then the case, Koch says, may "be pronounced cured." I repeat, this statement refers to early lung tubercle only.

As regards the immunity from tuberculosis which may be enjoyed by the human patient after such a course of treatment, no evidence, so far as I know, has yet been brought forward concerning it in clinical records from hospitals, though the protective power of the remedy has been established as a fact by Koch's experiments as regards beasts. The doses of the remedy are prepared as follows: Two dilutions of the fluid are in general use, a one-per-cent dilution and a ten-per-cent dilution. The one-per-cent dilution is prepared by putting 0·5 c. c. of the remedy into a glass vessel graduated up to 50 c. c. The vessel is then filled up to 50 c. c. with distilled water containing a half per cent of carbolic acid. One c. c. of this solution contains a dose of 0·01 c. c. of the remedy. Koch's syringe is graduated in milligrammes up to a capacity of 1 c. c.; therefore, if 1 c. c. of this one-per-cent dilution be placed in that syringe, each marked milligramme of it will contain a dose of the remedy equal to 0·001 c. c. The ten-per-cent dilution is used exactly in the same way as the one-per-cent dilution. Every milligramme of it contains 0·01 of the remedy, and by means of this stronger dilution the larger doses may be given, or, by dilution, any less dose that may be needed. The subcutaneous injection of the remedy is made in the skin of the back, between the shoulder-blades and the spine, or near the lumbar part of the spine. These parts are selected for this purpose because they are less sensitive than most parts of the skin, and because absorption takes place very quickly from their neighborhood. Before giving an injec-

tion the skin around the proposed site of puncture should be disinfected by means of a 1 in 40 dilution of carbolic acid. The needle should also previously to its being used be dipped in a 1 in 20 dilution of carbolic acid.

The reaction in tubercular cases consists in a gradual rise of temperature, beginning three to five hours after the injection. In ten to twelve hours it reaches its acme—namely, a temperature of 102° to 104° Fahr. It may even rise as high as nearly 106° Fahr. Shivering often occurs as the temperature rises, but it is not a constant symptom. Pains in the joints, increase of cough and expectoration, nausea and vomiting, headache, often frontal in position, and great prostration and drowsiness, sometimes deepening into stupor, are the symptoms of the reaction. In one instance a man who was tuberculous continued in a state of stupor for forty-eight hours after receiving a dose of 0·01 c. c. Slight icterus and a general papular eruption, which has been so very well described by Dr. Radliffe Crocker, in his paper in The Lancet of November 22d, are among the less frequent symptoms which follow the injection. The fever lasts, as a rule, for from fifteen to twenty-four hours, and is accompanied by an increase in the rate of the pulse and of the respiration. The fever gradually declines, and the temperature falls to subnormal, but often rises again to about 100° Fahr., less or more, and then gradually drops to normal. The patient, as a rule, suffers but little after the fever. Cases of lupus best show the local reaction, but, as Dr. Koch has perfectly described all that is meant by the local reaction, it is needless to trouble you now with a repetition of his words. I have also a case to show you which illustrates sufficiently well the early action of the remedy on lupoid tissues.—*Lancet.*

THE TYRANNY OF THE STATE.

By SAMUEL WILLIAMS COOPER.

THE duties of the individual to society, particularly in the crowded centers of the world, become every day more numerous and burdensome. Thousands of bulky volumes do not suffice to contain the common law, the codes, and the countless decisions under the same on this subject. The taking of human life and the throwing down on the street of a piece of waste paper are alike punishable as crimes. If two or three gather together on the corner of a public highway to discuss the many obligations they owe to the sovereign power, and raise their voices loudly, the state, in the form of a blue-coated officer, orders them off, and, if any objection or answer is made, clubs them to the station-house.

Thereupon the state becomes the accuser, the witness, and the judge, and, without an opportunity to be heard or to call witnesses in defense, the offenders are held to await trial. Should any one become disgusted with his duties as a citizen and attempt to end his misery, if caught in time, he may be punished as an abandoned criminal.

Amid this never-ending round of obligations the nature and limits of the authority that imposes them is a question seldom stated, yet it must be recognized as one of vast importance to mankind. The axiom that the people do not need to limit their power over themselves has been used to quiet all complaints, and the patients have gradually become stupefied by their own wisdom. There would seem to be an ever-increasing inclination on the part of the state to unduly stretch its rights over the individual—both by careless legislation and by indifference to its solemn obligations.

It is true, that to read the Scriptures in English or to speak against the Prayer-book is no longer a capital offense, nor are innocent old ladies executed at Salem for witchcraft; but personal liberty and the rights of property are constantly violated, and the citizen is utterly without redress. The comfort administered in monarchies to those who complained on this score was that the king could do no wrong; but a few years ago the Supreme Court of the United States declared that this doctrine had no place in American jurisprudence. This enunciation of a democratic feeling was, however, mere emptiness; for, in other cases before the same tribunal, it has been held as axiomatical that the sovereign power is free from all legal duties. Law, it is said, is a rule of action laid down by a superior; and the state can not be said to be in subordination to itself, excepting so far as it may choose to part with its sovereignty.

For many years the only redress against the United States for wrongs done by it was by bringing the injuries to the attention of Congress. Latterly the Court of Claims has been established, but has jurisdiction only to hear cases that arise out of contracts made within six years from the time suit is brought. For those older than this—for all sorts and the vast variety of claims that may arise, other than for mere money demands—the sole redress is still before the legislative body. It would take a series of volumes almost as great as those containing the duties of the individual to the state to recount the tales of robbery and outrage on the part of the national Government that appear in the appeals for justice now on record at Washington. Had these same acts been committed by private bodies, the united wrath of the people would have exterminated the offenders.

For goods or lands wrongfully taken by the officers of the

United States, although absolutely necessary for the support of the sovereign power, there is no liability; and if the claim is on contract, it must be shown to have been made with an officer authorized by statute to enter into the particular agreement. Although the claimant has been wrongfully kept out of his own for years, and finally recovers a judgment, the United States calmly tells him that it never pays interest on its debts (United States *vs.* Bayard, 127 United States Reports, 251); yet if it has a claim against a citizen who is insolvent it demands every dollar of it, with interest, before any other creditor can be allowed a cent (Brent *vs.* Baule, 10 Peters, 596). An action of ejectment for land taken by the Government will not lie. The officers who committed the act may be liable, but a judgment against them does not bind their principal (Carr *vs.* United States, 98 United States Reports, 433). The States are prohibited from passing any laws impairing the obligations of contracts, but the United States still reserves the power to itself of doing such wrongs (Evans *vs.* Eaton, Peters C. C., 323). The contracts with the Indian tribes are sad examples of this fact. Treaty after treaty of the most solemn kind, founded upon considerations of money and the deepest morals, has been violated with as much indifference as a man would brush a fly from his body. So the Supreme Court of the United States has declared that, notwithstanding the prohibition on the States, they may violate those contracts at will that they have made with the citizen, or by laws framed to protect his health, morals, education, good order, or the public safety. The elasticity of these words, as stretched by the judges, is greater than any lexicographer could have supposed them capable of. The injustice is not so much in the decisions on this point, however, as in the results—not so much in the wrongs done to the individual, that are often necessary—but in the failure of the state to provide any compensation for the injuries.

For example, the various prohibitory or high-license laws have had the direct effect, in countless instances, of taking the property of the individual and wrecking his life and business, yet leave him without redress. It has happened innumerable times that men who have spent enormous sums in enterprises connected with the manufacture and sale of liquor, in States which by their laws encouraged them, have been deprived of every dollar by subsequent legislation. In Pennsylvania, under the recent license act, property to the value of millions of dollars was destroyed, the future of many good citizens was ruined, and some were driven insane and committed suicide. These were engaged in a traffic made lawful by the State laws, and in many instances there was not a word of complaint as to the moral character of the applicants. The Supreme Court of the United States has sustained

such enactments on the ground that they are an exercise of police power, of the correctness of which, except in extreme instances, the State is the sole judge (Light Company *vs.* Heat Company, 115 United States, 650). To such an extent has this ruling been carried, that an act under which the sheriff was authorized to take possession of and destroy the contents of all liquor establishments, without making compensation, was held constitutional (Mugler *vs.* Kansas, 123 United States, 623).

There are bigots who will claim that this is a proper punishment for those who have been wicked enough to sell intoxicating liquors. These we refer to a late decision of the United States Supreme Court, arising under a statute of Pennsylvania in regard to oleomargarine (Powell *vs.* Pennsylvania, 127 United States, 678). In this case a citizen, a Mr. Powell, upon the faith of the two acts of Assembly that recognized the right to manufacture and sell oleomargarine, if properly stamped, spent a large sum of money in the erection of a factory. Subsequently another law was passed making it a misdemeanor to manufacture or sell such goods in any form. It was admitted that the food was perfectly healthful, cheaper than regular butter, and that it had been stamped as required by the earlier acts of Assembly. Despite this, the conviction of the citizen was sustained on the ground that the act was within the police power of the Commonwealth. It was held that it might be made a crime to sell any of the goods, because, if improperly manufactured, they would be injurious. As Justice Field, in a long dissenting opinion pointed out, almost every article of food on like grounds might thus be prohibited.

Could a greater outrage have been inflicted on a citizen? The State passes laws that provide for the manufacture and sale of a commodity; then, after the business has been established, makes the citizen a criminal who put his capital into it at its invitation. To produce a cheap, wholesome food would seem to be deserving of commendation rather than a prison cell. It is not necessary to read the dissenting opinion to be convinced that such a statute deprives the citizen of life, liberty, and property without due process of law. What should be said of a private person or corporation that committed the crime of inducing another, by false promises, to invest his all in a business acknowledged to be beneficial to mankind, and then deprived him of it and put him in jail?

To multiply cases on this point would be to detail outrages. The ruin that has been brought upon countless thousands can never be fully told. The power of the Government on such questions may be admitted to be absolute and necessary for control and good order; but, even so, the few should not be made to bear the burdens of the many without compensation.

The right of taking private property for public use is an incident to the sovereignty of every government; eminent domain, or inherent sovereign power, gives this control to the legislature—the interest of the public is deemed paramount to the individual, but the obliation is concomitant that in the exercise of the right full compensation shall be made. This is a fundamental doctrine, founded on national equity and a principle of universal law. As we have seen, however, there is a distinction made between property taken by right of eminent domain and that taken under the police power. In the former case just compensation must be made, in the latter none, although the act prohibited may have been lawful under previous statutes. There would seem to be no just reason for this difference. In either case the individual suffers for the benefit of the state. Indeed, in the exercise of the latter power the injury is often greater, in that it is unexpected, and hence can not be provided against.

Again, in the case of a contract made by a State directly with her citizens, as in the issue of bonds for the raising of revenue, there being no remedy by a suit against the State, the contract is substantially without sanction except that which arises out of the honor and good faith of the State itself, and these are not subject to coercion (Louisiana *vs.* Jumel, 17 Otto, 711). And although the State may, at the inception of the contract, have consented as one of its conditions to subject itself to suit, it may subsequently withdraw that consent and resume its original immunity without a violation of the obligation of its contract in the constitutional sense. Thus the State of Louisiana entered into certain engagements with her creditors; she embodied them in the most solemn form in her statutes and in her organic law; she provided for the levying of a tax to pay them; she prescribed certain duties for designated officers to perform in their collection and disbursement; she declared that no further legislation should be necessary for the collection of a tax or the appropriation of the proceeds, and that for the collection of the tax the judicial power should be exercised whenever necessary. In spite of all these seeming obligations and safeguards the Supreme Court, by a divided bench, decided that there was no power to stay repudiation. Substantially the same decree was made in the Virginia tax cases (*exparte* Ayres, 123 United States, 443). In these instances the States, after entering into the most solemn obligations with their citizens, deliberately and openly violated every principle of honor and good faith. To say nothing of the infamous wrongs inflicted, the influence of such actions on the morals of the people must be widespread.

The complications arising under the divorce laws of the various States have been dwelt upon at length of late by various

writers, and a full discussion of the subject here is unnecessary. Attention, however, may be called to the fact that a citizen who fails to observe the nice distinction laid down may find himself a vile criminal, with illegitimate children, because he failed, when the marriage ceremony was performed, to cross a river or step over a border line. This neglect of uniformity is a crime on the part of society toward its members that in this age of the world should not be tolerated.

Again, take the instance of a man accused by the state of crime who is innocent. All the power of the social body is exerted to make him out a criminal. He is put to enormous expense in the employment of counsel, the obtaining of evidence, and all the incidental expenses of a trial; his business may be broken up, and his hopes and happiness in life wrecked. Yet, even if he is proved innocent, the whole burden falls on him, for the state makes no compensation for mistakes. At the last session of the American Bar Association a resolution looking to the correction of this evil was presented and referred to a committee, and it is to be hoped that the influence of this body may not be without effect. The forms of verdicts should be modified so as to express fully and distinctly the guilt or innocence of the accused, and in cases where it is clear that the defendant is entirely without blame, he should be compensated for the wrong done him.

If the citizen is convicted of crime, what shall be said of his treatment? He is looked upon as one who has run contrary to the currents of society and involved it in disorder; yet, truly, he is rather an index of the civilization that holds him. He has fallen, not because he was worse than his fellows, but because bad influences surrounded his weaknesses. Between those who are out and those who are in there is often no more than the thickness of the prison doors. But the fact that a criminal who is caught is safely confined is deemed enough; his reform is a matter to which the state pays but small attention. How little has been done the records speak. In some places the unfortunates are bound in chain-gangs and hired out as slaves; in others, they are driven insane by solitary confinement; and, again, the young and innocent are herded with vicious age. For these wards of the state, for whose condition it is largely responsible, there is seldom any effort at improvement. Yet the thoughtful man will find in the study of criminals and their ways the courses of crime, and a partial solution of the problems of social disorder. There should be an opportunity given them to work out their freedom under conditions more hopeful than those found in the confinements of our prisons.

Almost all the States have provided in their Constitutions that no human authority shall interfere with the rights of conscience.

Yet no citizen will be allowed to give evidence in a court of justice who does not profess belief in a God and a future state. The result of this is that infidels may be looked upon as outlaws, and, if the conviction of a robber depends on their testimony, he may go free. This rule admits the evidence of those atheists who deny their faith, and excludes those who are brave enough to openly affirm it. A citizen's safety, rights, and property may thus be made to depend upon his belief. What rational man would not willingly believe the testimony of Huxley, Spencer, or Ingersoll on questions involving rights between themselves and other men? Yet these, under our free government, might be challenged as witnesses on religious ground, and thus deprived of the protection of the state.

By the Constitution of the United States all citizens are to be protected against all unlawful searches and seizures; but these rights are continually violated, without redress, by the action of brutal and ignorant officers who, without authority, make police raids and do irreparable injury to innocent men.

Space will not permit of the further recital of offenses, but what has been said will show clearly that the state has done acts that are as deserving of the name of crime as anything committed by the citizen; and, further, that we have drifted into a passive condition of assent to the doctrine that "we, the people," can do no wrong. The effect on the community of the ills that have been set forth is demoralizing, and weakens the stability of the state as a body.

The principal question of human affairs must ever be the proper adjustment of the rights of the individual as against society. The value of existence to the citizen depends upon the restraints placed on the actions of other people. Yet looking at the subject in its widest sense, how little has been done! The influence of custom is so great that the rules laid down by the superior power appear self-justifying. The struggle between liberty and authority—the man and the tyrant—has given place to a more representative government; but success in politics, as in persons, sometimes brings with it infirmities, and popular control may perpetuate in other forms the wrongs of despots long gone.

The question is not new. In some form or other it has been before mankind from the remotest ages. The law that the king could do no wrong has been declared inapplicable to our republican government. But in the monarch's place appears the hydra-headed tyrant—the state. The authority of this body, more dangerous than the power of the king, presents itself under new conditions that require deep consideration and fundamental treatment.

The remedy for many of the troubles is extremely simple. Let

the state be the subject of suit in all cases where it has injured its citizens by acts which would come within the cognizance of laws between individuals; let twelve men adjust the differences between the one who has suffered for the good of the many and the corporate body that represents the public. This is done in all cases where property is taken by corporations created by the state, and there is no reason to prevent the application of the same rules to the principal as is applied to the agents. The time has gone by for the invoking of ancient doctrines at the expense of the liberty and the justice due to the citizen.

Despite the fanciful theories of the new school of political economists, the strong force of personal impulses and preferences are the mainsprings from which the advancement of the world takes its movement. The protection of the freedom and rights of the individual against the power of the state is as important as that society shall be protected against him, and any system of laws or social science that ignores this fact is certain to retard the cause of progressive government.

GREETING BY GESTURE.

By GARRICK MALLERY.

II.

SALUTATIONS WITHOUT CONTACT.—The salutation now most prevalent among civilized people is the bow. That, in its abbreviated form, consists in a forward inclination of the head, sometimes accentuated by a corresponding motion of the arms, as in the *salam*, sometimes deepened by the depression of the upper part of the body. It is regarded by Herbert Spencer as merely a modification from the expressions of physical fear and bodily subjection noticed among subhuman animals and the lowest races of man. It originates, he says, with abject prostration and groveling, to which crawling and kneeling succeed, and the bow is but a simulated and partial prostration. An argument for this explanation is drawn from usages of savages and of antiquity.

A large class of obeisances undoubtedly had their origin in the attitudes of deprecation. A modern and familiar instance, also illustrative of the religious attitude of adoration and supplication, is in the "hands up" of our Western plains, which is an old Indian gesture sign for "no fight" or "surrender"—the palm of the empty hand being held toward the person to whom the surrender is made or implied. The Thlinkits, in addition to holding up their hands as a confession of utter helplessness,

also turn their backs. The concept of peace is close to that of surrender, and the Indian sign described is often used simply for "friend." The members of the Wonkomarra tribe salute one another on meeting by throwing their hands up to their heads. The etiquette of the Todas is in point to show that prostration and groveling are voluntarily performed in ceremony. One party falls at the other's feet, crouching, and the other places first the right and next the left foot on the prostrate head. But all this is done with high good humor as being the correct etiquette, and by no means cruel in the one party or shameful to the other. In southern India the inferior prostrates himself with extended arms to show entire helplessness. In Japan the host and hostess fall on their knees and lower their faces to the floor, the nose and chin resting on the back of the right hand, to which the visitor responds in the same manner. Sometimes both parties distinctly and repeatedly strike the floor with their heads.

It must also be admitted that the principle of the superior preserving an easy posture and the inferior assuming one of physical inconvenience is obvious in many ceremonials. In the court of France the right of sitting in the presence of the monarch, though on a low, armless, and backless stool called a tabouret, was jealously guarded, the exceptions even in favor of age and sex being made by special edict; and, although prostration is Mr. Spencer's great original of all respectful forms, recumbency in the court mentioned was not to be imagined. A quaint illustration of this is in the device by which alone it was considered possible for Louis XIII to pay a necessary visit to Cardinal Richelieu when confined to his bed. The king had another bed prepared, and on his arrival at once lay down on it himself, so that his subject had at least no advantage over him. The same concept rules the customs of many lands. In Monbutto no servant is permitted to address his superior except in a stooping posture with his hands upon his knees. The Hindoo in the presence of a Brahman raises his folded hands to his forehead, touching it with the balls of his thumbs, uttering at the same time a word meaning "prostration," which clearly explains the gesture. But notwithstanding this array of examples in favor of the origin of the bow from physical fear, there is reason to believe it had a separate and independent course of evolution, and that the subject is much more complex than as hitherto presented.

Mr. Spencer's theory about the origin of the bow must refer exclusively to the actions of the inferior toward the superior, in the same manner that his theory of the derivation of the handshake, really hand-grasp, depends upon the conduct of equals.

Both motions, however, are interconnected, and the weight of testimony inclines against both of his explanations. Most of his views expressed in his chapters on Ceremonial Institutions are beyond controversy, but regarding some portions in the narrow field of the present discussion there is now more known, through scientifically conducted explorations, than when those chapters were written. It is now possible to approach the subject from a direction to which Darwin led the way in his volume on The Expression of the Emotions in Man and Animals, and from study of the sign-language as still extant among some bodies of men.

Among several tribes the chief must never see any head more elevated than his own, so that the sitting posture, though one of greater ease, is one of respect. This is mentioned by the French missionaries in 1611 regarding the Iroquois and northern Algonquins. Sitting and kneeling are more distinct in territory than in concept. The male foot-scrape and the female courtesy, recently common in Europe in connection with the bow, may be relics of kneeling or simply of pretended lowering of the stature. Japan was emphatically the "kneeling country." The very costume of the Tycoon's court required the silk trousers to form an angle at the heels so as to trail far behind, thus simulating kneeling even when walking. But the Japanese habitually did not sit except in a semi-kneeling crouch, so that kneeling was to them the normal mode of lowering the person. In some other countries it was also forbidden to stand erect in the ruler's presence, but sitting took the place of kneeling. In Java sitting down is a mark of respect; in the Mariana Islands the inferior squats to speak to a superior, who would consider himself degraded by sitting in the presence of one who should be objectively as well as figuratively "below" him. Similar rules of etiquette prevail in Rotouma. Some of the African kings ingeniously reconcile the relative elevation with their own comfort by sitting down themselves while their subjects squat, kneel, or crouch. Prof. Hovelacque explains the dismounting of Kirghiz horsemen, when they salute, on the principle of descending from an elevation through courtesy. It is, however, probable that such dismounting is required as a measure of precaution, on the same principle that a horseman approaching a military picket is required to dismount before giving the countersign. This is both to insure the countersign being spoken so low as not to be overheard, and also to render less feasible a sudden attack and dash through the lines.

The relative elevation is an example of what is taught by oral as well as sign language to express the concepts of superior and inferior, above and below, high and low. A Cheyenne sign for "chief" pantomimically shows "he who stands still and commands;" but the most common sign consists in raising the index-

finger held upward, vertically to and above the head, the concept being "the one who is above others." The same sign has variants in many lands. Baker was greeted at Shoa by each native seizing both his hands and raising his arms three times to their full stretch above his head. Perhaps this was to make him give the sign of chief, which as in fact made by them through him implied, "you are our superior," "we submit to you."

The Andamanese salute by raising one leg and touching the lower part of the thigh with the hand. This gesture, which among some peoples is insulting, in the light afforded by sign-language may mean, "I am supposed to be sitting"—equal to the modern "your servant." With this expression may be compared the custom of the Zambesi, who, according to Livingstone, show respect by slapping their thighs, and gratitude for presents by holding them in one hand and with the other slapping their thighs.

The punctilios relating to the fundamental rule that rank is defined by elevation are carried to absurdity in the Orient. When an English carriage was procured for the Rajah of Lombok it was found impossible to use it because the driver's seat was the highest, and for the same reason successive kings of Ava refused to ride in the carriages presented to them by ambassadors. In Burmah, that a floor overhead should be occupied would be felt as a degradation, contrary to civilized ideas that the lower stories are the most honorable. In Siam, on the principle that no man can raise his head to the level of his superior, he must not cross a bridge if one of higher rank chances to be passing below, and no mean person may walk upon a floor above that occupied by his betters. On the same principle the furniture or stage setting for old ceremonies required the dais or raised platform for the seats of dignitaries. That elevation has become convenient for preserving order to officers presiding over assemblies, so that their seat has grown in prominence, while the royal or nobiliary dais has become exceptional or at least occasional.

From this executed concept of higher and lower the mere diminution of stature by bowing the head has possibly some relation. Explanation may be suggested by two salutations of the Chinese. Ceremonially they bend forward more or less deeply, with hands joined on the breast. Their less formal greeting is to raise the arms in front with the hands joined, thus forming an arch the elevation of which specifies the degree of respect. The Cossacks "bow to the girdle"—that is, bend forward so as to form a right angle at the waist.

In gesture-speech, the consensus throughout the world is that a forward inclination of the head, or in its place a similar motion of the hand in advance with an easy descent, as if in the curve of least resistance, signifies assent, approval, agreement.

It is the opposite of the transverse motion which shows negation, discordance, enmity, crossness. A lower inclination, either of head or hand, is emphatic, and often shows respect, not necessarily fear, as made to the older and wiser as also to the more powerful by rank or physical prowess. Forms of kindred expressions are still so common as to be classed as natural or involuntary. The head erect or thrown back with the eyes fixed to meet those of others shows haughtiness, defiance, or impudence. Casting down the eyes with an assisting inclination of the head is the evidence of modesty, yielding, gentleness, or subservience, according to the degree of action. Hanging the head may, however, exhibit dissent accompanied by shame. Le Page du Pratz gives an account of the gesture as observed by him among the Natchez at about 1718: "In the war-songs the great chief recites his exploits. Those who know them to be true respond with a long 'hou!' and certify their truth. Applause in the councils is also by the sound 'hou!' Their want of satisfaction is given by lowering the head and maintaining silence."

A more poetical and rather metaphorical variation sometimes occurs from the pretense of the unsupportable glory and brilliance of the dignitary approached, where the eyelids must be partially closed, a bow of the head assisting in their shading, and the hands sometimes advanced as an additional screen, in which motion the *salam* has a supposable origin. Curiously enough, this gesture, regarded as purely Oriental, was observed by Marquette on his visit to the Illinois in 1673, where "the Host stood before the Cabin, having both his Hands lifted up to Heaven, opposite to the Sun, insomuch that it darted its rays thro' his Fingers, upon his Face; and when we came near him, he told us, What a fair Day this is since thou comest to visit us!" Adair tells that the Southern tribes in the United States never bowed to one another, but did in their religious ceremonies, which perhaps was with reference to the effulgent rays of the sun, the object of their special adoration. Such instances tend to show that the origin of the bow was not always in the abjectness of physical fear.

Touching the ground in connection with salutation, though asserted to be derived from kneeling or prostration, does not necessarily arise from fear, or indicate any more than the relative higher and lower station. For instance, at Amorgos in the Cyclades the priest, on entering his father's house, touched the ground with his fingers, as a token of respect, before embracing him. His sisters touched the ground with their fingers before kissing the proffered hand of their brother. In each case there was expressed affection while the rank was recognized by the lowering reference to the ground. In the second dispatch of Cortes he

describes his reception by the principal Mexicans, each of whom put his own hand to the ground and then kissed it. A yet clearer illustration is shown in the practice still existing in some parts of Germany, that the inferior calling upon a high official should knock at the door, whether open or closed, of the latter's apartments, not at the convenient level of his hand, but low down near the flooring, thereby humbly indicating his station. An actual lowering of the head is required in these cases, but normally it is not seen and is only incidental to the main action. A truly gallant sentiment appears in the custom in some Dutch cities of bowing when passing the house where a lady friend resides, even though it may be certain that the salute can not be seen. Her presence, real or supposed, receives the compliment.

In southeastern Africa, two chiefs, each claiming to be at least the other's equal, can never meet because the initiative in salutation acknowledges the superiority in rank of the chief saluted. If no salutation is made, the followers fall to blows and war begins. But among the Mbengas it is the duty of the highest in position to make the first salutation, a curious example of the coincidence between the low types of man and the latest culture which rules that a lady has the privilege as well as duty of recognition. Such salutes must always be returned, and indeed nearly all forms and expressions of greeting must be reciprocated as made, even among savages who are the representatives of antiquity, this fact militating against the degrading origin of the bow, which could only apply when made by one party—viz., the inferior. To adduce one instance among many: The king of the Hoorn Islands, early in the seventeenth century, receiving the party of discovery, held his hands against each other with his face above them for two hours, lowering himself nearly to the ground, and remaining so until the visitor had paid him the like reverence. Until then the ceremony was incomplete.

The uncovering of the masculine head, with or without the forward bow, by removal of whatever head-dress is upon it, is also explained by Mr. Spencer on the principle of fear. It means to him a removal of part of the clothing as symbolical of the whole, and thereby is an abbreviation of the exhibition or pretense of poverty, helplessness, and abjectness by which the wrath or greed of a tyrant is deprecated. In support of this view many usages are cited in which whole or partial nakedness and displayed misery seem to become ceremonial. It is also true that the respective costumes of the master and servants were often designed to assert that the former alone was big. Not only such titles as Highness, Celsitude, and Altitude implied elevation before mentioned, but those like Majesty and Magnitude demanded the show of relative size. Similar devices to distinguish the great

appear in sign-language and picture-writing. In the ancient Egyptian pictures the king was always enormous and his surrounders were very small fellahs. The Mexican glyphs also signify great by big. Yet these devices do not conclusively show the effect of fear. They are but symbolic of high and low, big and little, as those figurative terms are applied to-day in English, and with corresponding significance in all languages, to discriminate between stations and ranks.

There are, however, instances directly opposed to the theory that uncovering is a mark of inferiority, and others are traceable to divers concepts. The Oriental custom of uncovering the feet, arising, as generally understood, in the imputation of holiness to a locality, has a curious parallel, if not an explanation, in the experience of Lewis and Clarke in 1805. The Western Indians, before the ceremonial smoke, "pulled off their moccasins, a custom which . . . imprecates on themselves the misery of going barefoot forever, if they are faithless to their words," on their thorny lands. A similar imprecation having regard to the burning sands in lands where the practice was first noticed might have induced it there. Should the religious ceremony in time be performed only at certain places or in buildings, the original significance would be lost and the locality itself simply considered holy. It is perhaps not fair to adduce historical cases in which the inferiors were expected to don their most sumptuous raiment to do honor to the king or general, while the latter, perhaps in affectation, was clad more soberly than any of his retinue. But there are many savage and ancient examples in which, instead of uncovering being the form for respect, envelopment, or indeed muffling, was adopted. Though generally in the Orient respect requires the feet to be bared, the head must be covered. The Israelite practice is familiar, and many other peoples, e. g., the Malabarese and the Malays, preserve covering on their heads in their temples and pagodas to show reverence. Although the New-Irelanders in respect take off the usual head-gear, they place their hands on their heads as a more honorable covering. Quakers, in avoiding the usual Christian ceremony of uncovering on taking an affirmation and on other religious occasions, use a pagan ceremony by insisting on keeping on their hats.

The Thibetans when before the *dolai-lama* remove their hats, cross their arms over the breast, and stick out the tongue drawn to a point. A collation of the known cases of the curious salute by the pointed tongue leads to the suggestion that it is connected with the conception before mentioned that the subject is too great to admit of speech. The extended tongue prevents speech as completely and even more obviously than does the covering of the mouth by the hand. It is, however, possible that the gesture

symbolically signifies reaching out for a good taste, which also has been discussed. This gesture is common among the Australians, who are said to stick out the tongue in respect, not in derision, as we would regard the action, as also did Isaiah in his query, "Against whom make you a wide mouth and draw out the tongue?" But close observers report that the Australian tribes wholly unaffected by Europeans do not thrust forward the tongue, but extend it downward from the widely opened mouth as in the preparation for licking. The action of these people, perhaps the lowest of all humanity, is similar to the tasting and sniffing by the subhuman animals to distinguish friends.

Cyrus beheaded two satraps because they omitted to place their hands inside their sleeves when they saluted him. Captain Speke had trouble in Uganda lest he should not be admitted into the king's presence wearing his usual dress, without the concealment of his trousers by flowing robes. Probably the origin of these rules of etiquette was the restriction from free motion of the arms and legs of the subjects, so as to insure greater safety to the ruler. In the one hundred and seventieth of the Arabian Nights' Entertainments Prince Camaralzaman showed respect for his father by keeping his hands joined behind his back and covered by his sleeves, but when he became angry with the king he unclasped his hands from behind and rolled his sleeves up on his arms. This is the fighting attitude, and shows that the posture and muffling of respect were adopted because they were the converse of the free pose appropriate for contention. With the same concept a Sahaptin chief, in the early part of this century, threw his robe down on the ground as a sign of displeasure, though not intending an attack.

Other considerations may be mentioned in the direct line of militancy so often discussed in the Synthetic Philosophy, but not definitely in this connection. Apart from the purely ornamental head-gear, such as feathers, horse-hair, fur, and other attachments, the earliest coverings for the head were for defensive purposes. The abandonment of defensive as well as of offensive armor, though once a mark of defeat and subjection, is now more generally a sign of peace and friendship. Some African tribes not only ostentatiously lay down all weapons but remove the upper portion of their clothing to show that neither arms nor armor are concealed. Some formal military salutes still prevailing may be consulted upon the same topic. The theory of these is to render the saluter actually or symbolically powerless for the time. This is the case with the firing of unshotted guns, the dropping of the sword-point, and presenting the musket. The common military salute, in which the empty hand, with palm outward, is raised to the visor, is less objective and more symbolical. Simi-

larly, the special naval salute by lowering sails and manning yards places the vessel in a position of inaction. In the same manner the removal of his helmet left the ancient warrior defenseless in the most vulnerable, often the only protected, part of his person. This action, therefore, would present a better argument for the surrender than for the beggary theory, and it is strengthened by the fact that women, who did not wear helmets, have not generally been required to remove their head-gear in public. It is also to be noticed, in reference to the interconnection of ceremonials, that the motion of removing the hat is normally downward, thus including the concept of assuming an inferior height before discussed. The crest, which often showed the warrior's cognizance, as the flag shows that of nations, was lowered, as the flag is, in formal respect. A pretended or symbolized uncovering and lowering appears when the English and French *prolétaires* and peasants pull a lock of their hair in servile obeisance to their superiors.

The special privilege in old Spain of wearing the hat in the presence of the sovereign may be compared with the limitation of sitting in the French court, before mentioned. Spanish grandees were distinguished by the cherished prerogative of wearing their hats before their king when his hat was on, though not when he was uncovered. Mr. H. Ling Roth, in his excellent paper On Salutations, falls into a small error on this subject. It was not, in the time of the Tudors, "the custom in England, when a gentleman lost his bonnet, for all those who were with him to doff theirs," nor was it simply the omission of that act as one of ordinary politeness which indicated the coming fall of Thomas Cromwell. That the courtiers should retain their hats while he was uncovered, was much more distinctly than mere rudeness the assertion that they did not consider him to be their ruler. All ambassadors have the privilege, though now seldom used, of putting on their hats when they read their reception speeches, the sovereign principal being then more specially represented than on any other occasion. When the Cossacks met for counsel, not being then an army but a brotherhood, they kept on their hats, but their *ataman*, when addressing them and explaining his cause, removed his head-covering. When he asserted command as the head of the army he donned his hat, and the same members of the council, before covered, removed theirs.

In most parts of the civilized world the hat, in ordinary greeting, is now seldom wholly removed from the head, and the latter is but slightly inclined. The action is much abbreviated, and doffing is simulated by a touch of the brim, or by a great variety of jerks or waves of the hand and arm to which the head-covering is the *point d'appui*. These motions are full of interest to

the gesture-reader. They generally suppose some degree of real or perfunctory respect, but may indicate pride as well as humility, familiar affection or cold formality, welcome or aversion, even irony or derision. The Poles and Cossacks use the phrase, "With the forehead to you," when, in fact, there is no bow made. This is on the same principle as the phrase, "I kiss your hands," when the hands are not kissed. Both expressions are relics of actions, and neither means more than the English "my respects." Likewise, through the Russian Empire, "I fall at your feet," is often said to men, and "I kiss your feet" to women, though those performances do not take place.

The above considerations lead to the conclusion that several known motions expressive of emotions, both separately and together, tend to explain the bow. Furthermore, these motions, and the emotions or concepts expressed by them, seem to be as ancient as any known to have been common among men. It will, therefore, appear that the genesis of our bow does not appear exclusively and among all peoples in the groveling of the whipped hound or the cowering of the dastard slave. Perhaps on examining all the tribes of men a theory that prostration was but an exaggerated bow might be as well maintained as one that the bow is a relic and symbol of prostration, but it is now only suggested that the two expressions may be independent.

Clapping Hands.—At this point an attempt may be made to explain the curious custom of clapping the hands in salutation.

Among the Uvinza, "when two 'grandees' meet, the junior leans forward, bends his knees, and places the palms of his hands on the ground on each side of his feet, while the senior claps his own hands six or seven times. They then change round, and the junior slaps himself first under the left armpit, and then under the right. But, when a 'swell' meets an inferior, the superior only claps his hands, and does not fully return the salutation by following the motions of the one who first salutes. On two commoners meeting, they pat their stomachs, then clap hands at each other, and finally shake" (i. e., take) "hands. These greetings are observed to an unlimited extent, and the sound of patting and clapping is almost unceasing." Serpa Pinto found this ceremonial clapping in violent exercise among the Ambuellas. Paul du Chaillu reports the salute of the Ishogos to be clapping the hands together and stretching them out alternately several times. Among the Walunga, in the morning, on every side a continuous clapping of hands goes on, with the accompaniment of "*Kwi-tata, kwi-tata?*" which is their mode of saying, "How d'ye do?" If a chief passes, they drop on their knees, bow their heads to the ground, clap vigorously, and humbly mutter, "*Kwi-tata, kwi-*

tata?" The clapping distinguishes the ceremony from that of mere prostration.

When the people of Londa wish to be excessively polite they bring a quantity of ashes or clay in a piece of skin, and, taking up handfuls, rub it on the chest and upper front part of each arm; others in saluting drum their ribs with their elbows; while still others touch the ground with one cheek after the other, and clap their hands. The chiefs go through the semblance of rubbing the sand on the arms, but only make a feint of picking it up. Among the Warna, an inferior in saluting a superior takes a piece of dried mud in his right hand; he first rubs his own left arm above the elbow and his left side, then, throwing the mud into his left hand, he in like manner rubs the right arm and side, all the time muttering away inquiries about his friend's health. Each time the chief's name is mentioned every one begins rubbing his breast with mud.

From these notes the elements of the clapping pantomime may be resolved into, first, beating or slapping the arms and upper parts of the breast, sometimes rubbing them with mud—these being ancient modes of expressing grief—and afterward the noise of the slaps is simulated by clapping the hands. It is well known that many peoples act both in pantomime and with speeches to disguise their happiness and thereby escape the notice of malevolent demons. It is also known that among certain tribes, on the meeting of friends who have been long absent, markedly when they have been in danger, the welcoming party gash their arms and breasts so as to draw blood, which placates the jealous gods on the joyous occasion. When the actions become simulated and symbolic, the claps in the examples cited may represent the wounding strokes, and the mud-stains imitate those of blood. When the superstition has decayed, such actions, and afterward their simulation, may be used as any happy greetings.

It is not forgotten, however, that clapping hands is used for applause and rejoicing, as in Ezekiel, xxv, 6: "Because thou hast clapped thine hands, and stamped with the feet, and rejoiced in heart." But "clap at" is used with hiss in Job, xxvii, 23, and also in Lamentations, ii, 15, to signify derision. In this respect the gesture shows the general nature of gesture-signs which, according to the manner of use and the context, can be applied with many shades of significance—indeed, by very slight changes can express opposite meanings. It is at least as flexible as oral speech, which gains the same result by collocations of words and modulations of voice.

JOY-WEEPING.—One of the most curious of the demonstrations upon the meeting of friends is that called "joy-weeping," which also may be connected with the dread of jealous demons. Cry-

ing, both with tears and with howls at such times of gladness, is known in many lands. It has been lately reported among the Andamanese and was noticed by Cabeza de Vaca in 1527 among the Caddoes of Texas and Louisiana. It may also be construed as mentioned about the ancient Israelites in the twenty-ninth, thirty-third, and forty-fifth chapters of Genesis, where weeping is recorded at the meeting of Jacob and Rachel, Jacob and Esau, and Joseph and Benjamin. Singularly enough, the same practice was found existing fifty years ago in central Australia, where parents upon meeting children after a long absence fell upon their necks and wept bitterly. The Tahitians cut themselves with shark's teeth and indulge in loud wailing to testify gladness at the arrival of a friend, and the New-Zealanders scarify themselves with lava on such meetings.

Dr. E. B. Tylor explains the practice as mourning for those who had died during the interval of separation, thus following Hennepin in his account of La Salle's visit to the Biskatronge nation in 1685 as follows: "At their arrival those people fell a-crying most bitterly for a quarter of an hour. This is their custom whenever there comes any strangers afar off amongst them, because their arrival puts them in mind of their deceased relations which they imagine to be upon a great journey, and whose return they expect every hour." The proceeding is explained in the account by Alexander Henry of the Assiniboin feasts in 1776 which were begun by the violent weeping of the whole party, and the reason they gave was that it was in memory of their deceased relatives whose absence was brought fresh into their minds. This religious ceremonial of the Indians was mistaken by some travelers for salutation, which it only resembled as the formal grace before meat resembles the modern "good-morning" or the libation among the Romans was analogous to the "*salve*" of their daily life.

Hennepin's explanation does not apply to the large majority of the cases known, and indeed is properly grief-weeping. If joy-weeping is not to be classed with the tricks to deceive the jealous gods, it possibly arises from the familiar agitation in which the signs of extreme joy and mirth are similar to those of grief. Most of us have laughed until tears rolled down our cheeks. Such exhibitions may have induced the real or imitative expression of joy by crying. In this connection it is curious that the English word "greeting," defined as a kind salutation, is still preserved in the lowland Scotch dialect with the sense of weeping or mourning.

THE HEART.—Gestures of salutation, the motions of which are directly connected with the heart, have some special interest.

In some Oriental countries the mere bow was not held to be enough. Sometimes the right hand was placed across the head.

Sometimes the hand was put first to the forehead and then to the heart—perhaps to symbolize that intellect and love are at the disposal of the one addressed. In this simple form, but as an invocation, the sign has been translated as "may my head be the penalty if my heart be false!" A similar gesture, imitating with the hand the act of cutting the throat, and sometimes before and sometimes afterward touching the heart, is represented as having the same significance, "On my head be it!"

In Greece the ancient style of greeting a priest is still observed by placing the hand on the breast and inclining forward; and the Lander party in the Niger basin were obliged to bend forward and to place their hands with solemnity on their heads and breasts. Tribes of Eskimos in 1833 saluted by patting their breasts and pointing to the heavens. In the same year a Kansas warrior grasped hands with the party greeted and then pressed his own bare breast. In 1886 tribes of eastern equatorial Africa, with the same intent of friendship, grasped hands and rapped their own breasts. All these gestures meant that the heart was "good," perhaps poetically then it beat in sympathy. The Fuegians, as a greeting of friendship, pat their own breasts, concluding by three hand-slaps given at the same time on the breast and back of the friend, then bare their own bosoms for a return of the slaps. A Texan tribe, in 1685, expressed friendship by laying their hands on their hearts, and evidently expected La Salle's party to respond in the same manner, which was done. A Ha-va-su-paí, of Arizona, grasps the hand of a friend on meeting, moving the hand up and down in time to the words of his greeting; and, as he lets it go, lifts his own hollow palm toward his mouth, then, with a sudden and graceful motion, passes it down over his heart. Here, in addition to the concluding emphasis connected with the heart, there is a motion which might be mistaken for hand-kissing, and also the nearest approach to "shaking" the hand among savages or barbarians which has been accurately reported. But to beat the time of a rhythmic formula is very different from the English pump-handle shake, even when it was less hideous than the last "fad" with the raised elbow, and its intent is the very opposite of Mr. Spencer's struggle.

Two of the special signs for "good" in the sign-language of the Indians may be mentioned as in point. Hold the extended right hand, back up, in front of and close to the left breast, fingers extended, touching, and pointing to left (index-finger usually rests against the breast in this position); move the hand briskly, well out to front and right, keeping it in the same horizontal plane. Concept, "Level with the heart." Or pass the opened right hand, palm downward, through an arc of about ninety degrees from the heart, about two feet horizontally forward and

to the right. "Heart easy or smooth." "My bosom's lord sits lightly on its throne."

The kalmucks salute their high chiefs by pressing the forehead with the clinched hand, and then touching the chief's side with the same hand. The chief responds by placing one of his hands on the saluter's shoulders. This may be translated as "My head is dependent on the emotion of your heart"; and the response is, "I accept your offering, and recognize that I possess you."

Intimately connected with the imagery of the heart is the union by exchange of blood. In ancient Persia, as in modern Africa, it was common to open a vein and then present the blood to be drunk by the friend. This was and is often mutual. Perhaps it is straining the illustration to infer that when the Wanika, after the hand-grasp, press together the balls of their respective thumbs, it is to effect the union of the pulsations. It is, however, in point that the Norse pledge of friendship was to allow the blood to flow between the pierced and grasped hands, and it has been conjectured that "striking hands," often alluded to in the Old Testament (e. g., Proverbs, vi, 1) as a ceremony of covenant, meant an actual intermingling of blood from the pierced palms, or at least was a relic and symbol of that form. But it is fanciful to explain the simple hand-grasp from this blood-mixing; indeed, all symbolism should be closely scrutinized. Stanley reports that the natives of Panga, as a peace greeting—being at a distance from the party greeted—poured water on their own heads and sprinkled their bodies with it. Much of the symbolism about the solvent and cleansing qualities of water, including origins of lustration and baptism, might be deduced from this performance, but it was simply the sign of coolness and refreshment elsewhere mentioned in these pages.

Miscellaneous Salutes.—It is impossible, within present limits, to detail the world's many forms of gestural salutation. They, like all gesture-signs, show different conceptions of the same general intent and different modes of expressing the same concept. They are also in many cases so abbreviated and modulated as to be intelligible in their present forms only through comparison and investigation. A few salutes having special interest may be mentioned.

The important mystic agency of saliva has before been noticed in connection with the hand-grasp. It is too large a topic to be now dwelt upon; but some examples may be given of its immediate connection with salutation. Among the Masai, spitting expresses the greatest good-will and the best of wishes. It takes the place of the compliments of the season. They spit when they meet, and do the same on parting. In some of the South Sea islands they spit on the hands and then rub the face of the com-

plimented person. Schweinfurth says of the Dyoor that mutual spitting betokened the most affectionate good-will.

The inhabitants of Hainan gracefully greet a guest by extending the arms, the hands open with the finger-tips touching, or nearly so, and drawing them inward with an inviting motion. They bid farewell by extending the open hands with the palms upward and slightly inclined outward, in a movement as if handing the friend on his way. In arctic America there is a queer example of returning a kiss for a blow. A stranger coming to the village is regaled with chant and dance, after which he folds his arms, and the head Ancoot hits him as hard as he can on the cheek, often knocking him down. The actors then change parts, and the visitor knocks him in the same way, after which they kiss (probably on the cheek, but not described), and the ceremony is over.

In this connection the supposed hand-kissing struggle to explain the hand-grasp may again be mentioned with an additional criticism. The hand-grasp was common among those peoples of the world who now use it in greeting before altruism had made so much progress as to reverse many of the old conventions of precedence.

After examination of the whole subject there appears to be significance in the connection before suggested between the offering of the unarmed hand and the strictly military salute with sword, rifle, and cannon. They all display temporary defenselessness, though not now through fear, but the reverse—trust and confidence—and they are always returned with rivalry only in the demonstration of amity. This is but one instance to prove that militancy is not a mere incarnation of evil and drag upon civilization. Spencer accuses it of paralyzing humanity through fear, of originating deception and lies, and of antagonism to justice and mercy. But militancy has shown a most interesting and instructive evolution within itself. Modern armies, by the education and discipline enforced, furnish to the world perhaps as large a number of really valuable men as they cost.

It will be noticed that in proportion to advance in civilization and culture, gestural salutations—as is also true of the verbal—are exchanged or returned, thus denoting a mutual sentiment or sympathy. A gesture of greeting is now seldom made exclusively by one class to be merely received by another, but meets with reciprocity, though often in abbreviation. It is not contended that the most degrading theory of the origin of some of the gestures treated of may not be correctly applied to some tribes and regions, though it is suggested, from the information given by sign-language and from many compared facts, that among other peoples those gestures originated in different and

independent concepts. But if cowardice and slavishness gave the true and only explanation, still more pointed would be the lesson taught by the modern general exchange of the same courteous action between strong and weak, rich and poor.

The history of salutations does not directly show the contest of good and evil or of any principles, but it illustrates the transition from egoism to altruism. Whatever was a custom, men considered to be right, while it lasted. Men have not at any time chosen between industrialism and militarism, but an evolution has proceeded in industrialism and militarism themselves as also in peoples, who have advanced, though slowly and with stumbles, from lower to higher planes of culture. Differing environments affected their earliest conceptions and practices, and expedited or delayed their march. Those peoples who have reached civilization and enlightenment can still find the representatives of their early greetings among remote savages, and perhaps trace some of the salutations above mentioned to subhuman ancestors. Ages before the great poet wrote, the human race obeyed the precept, to

"Move upward, working out the beast,
And let the ape and tiger die."

NOTE.—A similar study of verbal salutations, inculcating the same lessons as the present article on gestural greetings, has been published by the same author in the American Anthropologist for July, 1890, under the title of Customs of Courtesy.

[*Concluded.*]

NON-CONDUCTORS OF HEAT.

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IT is a matter of common observation that a hot body continually gives off its heat to things around it, until at length the giver and the receivers all come to a common temperature. This gradual equalization may be brought about in three different ways: In the first place, heat is thrown off in every possible direction from every point of a heated body by what we call radiation. Secondly, when air, water, or any other fluid is in contact with a hot surface that is not directly over it, the touching particles become warm and light, and move away to give place to others. This carrying away heat by the successive particles of a fluid is called convection. In the third place, when a solid substance is placed against anything of a higher temperature, its nearest parts are warmed and give up a portion of the heat received to those parts lying next to them; and these, again, share their gain with those next in order; and so on, till

finally the outer surface heats whatever is in contact with it. Such conveyance of heat from particle to particle, without sensible motion, is termed conduction.

Strictly speaking, according to modern theory, radiant heat is a peculiar kind of undulation communicated to a supposed exceedingly subtile, all-pervading ether; and conduction is an oscillation of the molecules of the conductor itself. But, though we no longer consider heat to be a substance, it is convenient to use the old terms figuratively in describing the phenomena, just as we still say the sun rises and sets, though it is the earth that moves.

When we sit near an open fire, we are warmed by radiation through the intervening air, while the air itself is heated by contact with the fire and passes up the chimney. So radiation and convection, or radiation and conduction, may go on at the same time, and when cooling takes place it is not always easy to tell how much of the effect is due to each of the causes respectively. Hence, substances that are put around hot bodies to retard the change of temperature are often called indiscriminately non-conductors, though in fact they may act partly by preventing convection or by intercepting radiation. Practically, indeed, it is of little consequence to decide exactly how the loss of heat is prevented, but, in the full study of retentive coverings, we must not altogether lose sight of the distinction between mere conduction and general transmission.

It is a matter of much interest as well as of economical importance to find out what substances are most suitable to keep hot bodies warm and cold bodies cool; and several methods have been devised for making either absolute or comparative trials. After due consideration of the plans used by different experimenters, the writer has adopted, for the many determinations which he has had occasion to make, an apparatus which may be arranged in three different ways: First, a short, cylindrical metallic vessel, with the flat ends vertical, is kept at a constant high temperature by a continual current of steam or hot water passing in at the bottom and out at the top. The non-conductor, of a regular thickness, say one inch, is applied to one of the flat faces of the heater. The other surface of the covering is in contact with a thin brass box, or calorimeter, filled with a known quantity of water to receive the transmitted heat. The number of degrees which the water is raised in an hour gives a definite measure of the amount of heat that the covering allows to pass through.

Secondly, in trying liquids or air for their conducting power it is desirable to get rid of convection by heating from above, so that the hottest part of the fluid shall be and remain at top.

Therefore the heater is suspended with its used face downward and exactly horizontal. The calorimeter, with its face also horizontal, is placed at any chosen distance below the heater, and is furnished with a curb of well-varnished pasteboard extending up a little higher than the face of the heater. This curb is of a somewhat larger diameter than the hot box, so that there is a free space all around, and very little heat can be conducted by it.

Thirdly, in making practical tests of coverings for steam-pipes the non-conductor is put entirely around the pipe and the calorimeter is made in two parts with concave sides to fit the covering. Of course, in all cases the whole apparatus is surrounded by cotton-wool or woolen blankets to prevent the disturbing influence of the surrounding air.

With the first arrangement, if the space between the calorimeter and the heater is filled with air only, which is confined by a curb of paper, but is free to circulate within the inclosure, the heat passes over rapidly, especially when the heater is at a very high temperature, while in the second apparatus the transmission is slow. In the former case, convection has full scope; in the latter, the air is stagnant and the heat passes downward by conduction and radiation. Therefore, still air has very little transmitting power, and confined air which is free to move around within the inclosure conveys heat readily.

Yet it is a not uncommon belief that, as air is a poor conductor of heat, a mere inclosed air-space around a hot or a very cold body suffices to prevent change of temperature. It is said by some that an ice-pitcher or a refrigerator needs only a double wall and no filling between. And we occasionally meet with loose statements like the following: "Confined air has long been regarded by scientific and practical men as one of the best non-conductors of heat." But it should be remembered that imprisonment is not always close confinement. The air must be fettered so that it can not stir.

Now, if we fill the space in either the first or the second apparatus with cotton or fine wool, we shall find the transmission even less than with still air. And yet the fibrous matter may actually occupy only a hundredth part of the space which it apparently fills, and the fibers can touch the heated surface and each other only in a few points. Therefore the specific conducting power of wool or cotton can have very little to do with their capability of keeping back heat. We know not precisely what the conducting power of the solid matter of cotton may be, for we can not compress the fibers far enough to destroy their elasticity and expel all the included air. But the woods are very similar in substance, and some of them are two thirds as dense as fully compacted cotton would be. One of the dry, hard woods, heavy enough to sink

in water, was found to have about four times the transmitting power of loose cotton. Were the transmission due to the substance of the fibers themselves, it would be increased by packing more in the same space. But, in fact, it is found that it is somewhat diminished by moderate crowding.

It would appear, then, that the efficiency of light non-conductors must be owing mostly to the imprisoned air which really occupies all but a small fraction of the space; and the stiller the air is held, the better is the effect.

Of course, the amount of friction which fibers can oppose to the motion of the entrapped fluid depends on their minute structure and arrangement. Thus in cotton they are long, flat, twisted, irregular in breadth, and variously bent. And as to fineness, it was found by counting and weighing some Sea Island cotton fibers averaging about an inch and a half in length, that it would take seventeen thousand to weigh a grain. Wool is scaly and very crinkly. Down is made up of flat threads with innumerable short, loose branches. The heads of the common cat-tail (*Typha latifolia*), which make a good non-conductor, consist of brown seeds, each having a stalk with very spreading branches. The seeds, with their appendages, are so very fine that eight hundred of them weigh only one grain. They may well float, as each one, for its weight, presents a very extensive surface to the air; and, for the same reason, in mass they serve to keep the air stagnant.

Ground cork and some other barks, and the sawdust of the soft woods, as well as the charcoal made of these substances, are very good retainers of heat. Lampblack also works well. When the thing to be kept hot is at a very high temperature, some light, incombustible powders are very suitable. Among the best of these are fossil meal and the calcined magnesia and magnesium carbonate of the druggists. Fossil meal consists of the silicious skeletons of microscopic vegetables, called diatoms, exceedingly various in shape and size, the very largest of them hardly reaching the length of the hundredth of an inch. It is found abundantly in some peat meadows and in the bottoms of ponds. Both fossil meal and magnesium carbonate have been largely used in covering steam-pipes.

Obviously, when the same light substance is tried in both the first and second apparatus above mentioned, and the results differ, it must be owing to the inability of the substance to hold the included air still in the first arrangement. So powdered plumbago, or black lead, which is very slippery, shows nearly twice as much transmissive power in one case as in the other. Loosened asbestus fiber also lets through about twice as much heat in the vertical arrangement as in the horizontal. Yet this fiber may be split up exceedingly fine; but the great difference in its behavior

as compared with cotton or wool must be owing much less to its own greater specific conducting power than to the smoothness and inelasticity of its fibers. It has too slight a hold on the included air. The more finely shredded it is the better it works; but our experiments have proved that it is not to be recommended as a non-conductor. And yet asbestus is often spoken of as though its excellence in this respect were unquestionable; but, because this wonderful mineral is very useful in many ways by reason of its incombustibility, it does not follow that it has any magic virtue in its other relations to heat. Asbestus paper intercepts heat somewhat better than the loose fiber; but a great many layers must be put together, and then the virtue is by no means commensurate with the cost. It is sometimes recommended as a suitable article to put between floors to prevent the spreading of a possible fire; but those who propose it for this use seem to overlook the fact that the efficiency of non-conductors is nearly proportional to their thickness, and, though an inch might be of some service, one fiftieth of an inch can do very little good.

Fibrous matters and powders in the loose state are somewhat troublesome to confine in the form of coverings, and hence they are sometimes consolidated into sheets or blocks which can be handled without breaking and applied easily. Hair-felt, which is made in thick sheets from the hair which tanners scrape from hides, is cheap and is very serviceable when the heat is not scorching. Paper pulp has been formed into very thick, hollow, half cylinders to put around steam-pipes. Carbonate of magnesium and fossil meal cohere when moistened and slightly compressed, and they may be made into slabs with the addition of a very small percentage of hair or asbestus to give toughness. Such a paste may be plastered directly on steam pipes or boilers and allowed to dry, the fiber serving to prevent cracking; but the greater compactness of light materials so consolidated renders them less effective, especially when a heavy cementing substance is added, like clay or plaster of Paris.

Of non-conducting substances that are already in the solid form, the light woods are often used advantageously. It should be noticed that most of them conduct heat much better along the grain than across it. Thus a cross-section of *Liriodendron*, or yellow poplar, was found to transmit heat nearly twice as fast as a board of the same thickness sawed lengthwise. Cork is expensive and hard to get in large pieces; but it is far preferable to wood, as it is lighter and more elastic and does not absorb water. Very porous and light bricks confine heat much better than those that are hard burned, but they must be kept dry.

The presence of moisture in a non-conductor greatly impairs its usefulness, as every one knows who has attempted to hold a

hot body with a damp cloth. Count Rumford, who long ago did much valuable work in the experimental study of heat, concluded that fluids have no conducting power at all, but transmit heat solely by convection; and, accordingly, water is still sometimes spoken of as an exceedingly poor conductor. But later investigators have disproved the correctness of that idea. Our own trials show that, when convection is obviated, water transmits in a given time six times as much heat as hair-felt of the same thickness, and nearly eight times as much as still air. Others have found that bisulphide of carbon and ether transmit heat even better than water; but most liquid substances are slower conductors. Thus it takes more than twice as long for a given amount of heat to pass through cotton-seed oil or lard oil as through water.

As to the gases, some physicists seem to have proved that heat passes through air more readily than through a vacuum, while hydrogen has six times as much transmissive power, and carbonic acid half as much as air; but none of them used apparatus that would give absolutely certain results.

To show more clearly the retentive power of various substances, we subjoin the following table, in which the first column of figures shows the net percentage of solid matter in a given space. The second column of figures gives the number of English units of heat transmitted in one hour through one square foot of the covering one inch thick, the average difference of temperature between the heater and the water in the calorimeter being 100° Fahr. By the English unit of heat is meant as much heat as will raise the temperature of one pound of water 1° Fahr. Of course, the smaller the number in the last column the better is the substance for keeping a body warm or cold.

In some of the experiments the source of heat was steam at 310° Fahr. In the others a stream of water at about 176° Fahr. was kept running through the heater.

It is plain that in choosing non-conductors for practical service we should take into account something more than their heat-retaining power. They should be of materials that are abundant and cheap; clean and inodorous; light and easy of application; not liable to become compacted by jarring, or to change by long keeping; not attractive to insects or mice; not likely to scorch, char, or ignite at the long-continued highest temperature to which they may be exposed; not liable to spontaneous combustion when partly soaked with oil; not prone to attract moisture from the air; and not capable of exerting any chemical action on surfaces with which they are placed in contact. There is no one thing which combines all the desirable good qualities, but there is a considerable range of substances which fulfill most of the require-

NON-CONDUCTORS ONE INCH THICK.	Net cub. in. of solid matter in 100.	Heat units transmitted per sq. ft. per hour.
Still air	....	43
Confined air	....	108
" " = 310°	....	203
Wool = 310°	4·3	36
Absorbent cotton	2·8	36
Raw cotton	2	44
" "	1	48
Live-geese feathers = 310°	5	41
" " "	2	50
Cat-tail seeds and hairs	2·1	50
Scoured hair, not felted	9·6	52
Hair-felt	8·5	56
Lampblack = 310°	5·6	41
Cork, ground	....	45
Cork, solid	....	49
Cork charcoal = 310°	5·3	50
White-pine charcoal = 310°	11·9	58
Rice-chaff	14·6	78
Cypress (*Taxodium*) shavings	7	60
" " sawdust	20·1	84
" " board	31·3	83
" " cross-section	31·8	145
Yellow poplar (*Liriodendron*) sawdust	16·2	75
" " " board	36·4	76
" " " cross-section	30·4	141
"Tunera" wood, board	79·4	156
Slag wool, best	5·7	50
Carbonate of magnesium	6	50
Calcined magnesia = 310°	2·3	52
"Magnesia covering," light	8·5	58
" " heavy	13 6	78
Fossil meal = 310°	6	60
Zinc white = 310°	8·8	72
Ground chalk = 310°	25·3	80
Asbestus in still air	3	56
" in movable air	3·6	99
" " " = 310°	8·1	210
Dry plaster of Paris = 310°	36·8	131
Plumbago in still air	30·6	134
" in movable air = 310°	26·1	296
Coarse sand = 310°	52·9	264
Water, still	....	335
Starch jelly, very firm, "	....	345
Gum-arabic mucilage, "	....	290
Solution sugar, 70 per cent, "	....	251
Glycerin, "	....	197
Castor oil, "	....	136
Cotton-seed oil, "	....	129
Lard oil, "	....	125
Aniline, "	....	122
Mineral sperm oil, "	....	115
Oil of turpentine, "	....	95

ments. For steam-pipes there have been many more or less suitable coverings in the market. But one should receive with much allowance the representations of dealers, who sometimes continue to advertise what has been proved to be of inferior value. Not uncommonly they are anxious to sell that on which they can make the most profit rather than that which is most efficient.

ON VÕDU-WORSHIP.

By Hon. Major A. B. ELLIS.

SIR SPENCER ST. JOHN'S book Hayti, or the Black Republic, brought prominently before the English-speaking peoples of the Old and New Worlds the subject of the so-called vaudoux or voodoo worship which prevails in the island of Hayti-Santo Domingo; and the numerous articles published from time to time by Mr. G. W. Cable in Harper's and the Century Magazines have shown us what the "voodoo-worship" in Louisiana is like; but, as neither of these two authors has, apparently, had any personal acquaintance with that part of the west coast of Africa from which võdu is derived, they have, very naturally, been unable to more than describe it as they found it on this side of the Atlantic. They have been unable to tell us to what language the word *võdu* belongs, what it means, and what the various practices which in Hayti and Louisiana are roughly grouped together under the designation of vaudoux-worship really are. I fancy I can recollect an article, but by whom written I can not remember, in which the writer derived the word *vaudoux* from *Pays de Vaud;* and, as some light seems to be required on the subject, it is here proposed, though now perhaps rather late in the day, to give it.

The word võdu * belongs to the Ewe language, which is spoken on the Slave Coast of West Africa, between the river Volta on the west and the kingdom of Porto Novo on the east, and extends inland, as far as is yet known, about one hundred miles. It is derived from the verb *võ*—to inspire fear—and is used in just the same way as English-speaking people use the word "fetich"—that is to say, it is used as a descriptive noun "god," and also as an adjective in the sense of sacred or belonging to a god. Thus any native god may be described as *a* võdu, and his image, paraphernalia, and sacred tract of bush called võdu. A priest is termed võdu-no—"He who stays with the võdu." The word is not an epithet of any particular god, it is a general term; and it is, therefore, incorrect to say that "it is the name of an imaginary being of vast supernatural powers residing in the form of a harmless snake." No doubt the python-god, worshiped by the inhabitants of the southeastern districts of Ewe territory, may very correctly be described as a võdu; but it is not more a võdu than Khebioso, So, Legba, Bo, Hunti, Wu, and the other gods of the Ewe pantheon. The expression "võdu-worship" means, then, "god-worship," which is a rather comprehensive term.

* The Greek circumflex here indicates a highly nasal intonation. The u, as in all West African languages, is pronounced like oo in English.

Vŏdu worship, in so far as it relates to the worship of a snake, was undoubtedly introduced into Hayti by slaves from Whydah and Ardra, or Allada. Moreau de St. Méry, an old author who described Hayti while it was still a French colony, and who is quoted by Sir S. St. John and Mr. Cable, distinctly says it was introduced by the "Aradas"; and it is only in the neighborhood of those two old kingdoms that python-worship is to be found on the Slave Coast at the present day. Whydah and Ardra were, at the beginning of the eighteenth century, two small states situated near the southeastern corner of Ewe territory. Whydah, which had a sea front of some thirty miles, extended inland about seven miles, its northern boundary being a lagoon which ran east and west just beyond the town of Savi, called Xavier by old writers. Ardra, or Allada, lay inland of Whydah, and extended as far northward as the marshy belt called the *Ko*—that is, to about thirty-five miles in a straight line from the sea. Its capital, Ardra or Allada, formerly a large and populous town, is now a miserable village, with a population of some three hundred souls.

The inhabitants of these two kingdoms were essentially commercial, and acted as middle-men between the inland tribes and the Europeans who frequented Whydah in their ships. Of these interior tribes, Dahomi, about 1625, became the most prominent. It gradually subjugated the surrounding peoples, and, in 1723, Guadja Trudo, the then King of Dahomi, was sufficiently powerful to demand of the Ardras a right of way and free traffic to the sea. The Ardras refused. The Dahomis invaded their territory in 1724, defeated them in a great battle, and the kingdom of Ardra was at an end. Three years later, in February, 1727, Guadja Trudo made a similar demand upon the Whydahs; the king of the latter also refused compliance: his territory was at once invaded and the kingdom overthrown. These two invasions fix for us the date at which snake-worship was introduced into Hayti; for thousands of Ardras and Whydahs, prisoners of war, were sold to the slave-traders and shipped across the Atlantic. For a good many years before the downfall of these kingdoms Whydah had been the chief, probably the only, slave emporium of the Slave Coast, and large numbers of slaves had thence been exported; but these earlier slaves had not been Ardras and Whydahs, among whom alone the python-worship prevailed; they were Mahis, and members of the various small tribes which had been defeated by Dahomi, and whom the people of the two seaboard kingdoms had bought from the latter to sell to the white men.

It was, then, the war captives taken at the conquest of Ardra and Whydah who brought both the word vŏdu and the snake-worship into Hayti; and if it be asked how it is that the other

West Indian Islands are at the present day free from every trace of the *cult*, the explanation is ready. The English supplied their colonies with slaves from their forts on the Gold Coast, and the great majority, so great as to comprise almost all the slaves imported into the British West Indies, were what were called, in the jargon of the slave trade, Coromantees, a designation which was a corruption of the name of a town called Acromanti, situated some fifteen miles to the east of Cape Coast Castle, and where the first English fort on the Gold Coast was built. These Coromantees, all members of the Tshi-speaking tribes—the Ashantis, Denkeras, Akims, Assins, Fantis, etc.—were noted for their superior physical strength, and for their ferocity and rebellious disposition. Every slave rebellion in the British West Indies, from the first in Jamaica in 1690 to the last in 1831 in the same island, was a rebellion of Coromantees; and their dangerous character was so well known that other nations did not care to purchase them. The Royal African Company had a treaty with Spain by which it undertook to supply the Spanish colonies with Eboe or Ibo slaves from the delta of the Niger, who, though of inferior physique, were preferred on account of their docility; and the French obtained their slaves principally from Whydah, though partly also from Senegal. Hence the great mass of Ardras and Whydahs were shipped to the French West India Islands, and no doubt the snake *cult* was introduced into Martinique and Guadeloupe as well as into Hayti. All such vōdu or "fetich" practices were, however, sternly suppressed by the planters, partly because they themselves feared them and had a superstitious belief in their power for evil, but principally because it was by their means that the more restless and uncontrollable slaves instigated their more docile brethren to rebel. There was the religious element at the bottom of every outbreak, and consequently all vōdu practices were forbidden under heavy penalties. But such superstitions die hard; and though we do not now hear of any vōdu-worship in Martinique and Guadeloupe, yet it is probable that, if the negroes of those islands had succeeded in achieving their independence, we should find it in as full vigor there as we do now in Hayti.

At the date of the overthrow of Ardra and Whydah, Louisiana was also a French possession, colonized by the French Mississippi Company; so we might reasonably suppose that some Ewe-speaking slaves were introduced there also, though it seems that the colonists obtained a great many from English slave-traders. But in 1809 a large number of French planters with their slaves, who in consequence of the insurrection in Hayti had sought refuge in Cuba, were compelled by the outbreak of war between France and Spain to quit their asylum, and landed in New Orleans. There were about five thousand eight hundred in

all, whites, mulattoes, and slaves, and the latter, no doubt, brought into Louisiana the word võdu and the snake-worship.

That the Ardra and Whydah slaves should have clung more tenaciously to the worship of their snake-god than to that of the other deities of their native country is explained by the fact that the python-god was the national god. According to existing tradition, the people of Whydah advanced the python to the dignity of their chief tutelary deity on account of the signal services it rendered when they were attacked by some powerful foe. Overwhelmed by superior numbers, they were giving way in every direction, when all at once the python-god appeared in the broken ranks, caressed the warriors with his head and tail, and inspired them with new courage; so that, when the chief priest raised the god on high at arms' length, and showed him as a guarantee of victory, the Whydahs rushed forward in a frenzy of enthusiasm, swept back the foe and utterly routed him. It was on account of this service, says the tradition, that the Whydahs built at Savi an elaborate temple, in which the priests professed to keep the very snake who had brought them victory. So confident were the Whydahs in the power of their god that, on the approach of the invading Dahomi army in 1727, instead of concentrating their forces at the lagoon to the north of Savi, which was only fordable at one point and on a narrow front, and so might easily have been held against superior numbers, they remained quietly at home and confided the defense to a python, which they placed on the southern bank. The Dahomis soon discovered this, crossed the lagoon without opposition, killed the python, and captured Savi.

The Dahomis treated the snake-gods with contempt, and destroyed the temple at Savi, but they did not prohibit the worship; and the remnant of the Whydahs who escaped the slaughter of the conquest continued it, with the result that after a quarter of a century or so the more southern Dahomis adopted the worship themselves. Some fugitives from Ardra, who fled to the eastward and founded the kingdom of Porto Novo, a new Ardra as it was then called, established the worship there; and these places, with Agweh and Little Popo to the west, to which the *cult* has within the last half-century spread from Whydah, are the only ones in which python-worship prevails.

The name of the python-god is Dañh-gbi (*dañh*, snake, and *agbi*, life). He is the god of wisdom, to whom all things are known, and, as he opened the eyes of the first man and the first woman, who were blind, he is the benefactor of mankind. He must not be confounded with the Great Snake of the Heavens, Anyiewo, sometimes called simply Dañh, who is the Rainbow-god. Dañh-gbi has his own order of priests, and, like all the

chief gods of the Ewe-speaking peoples, numerous "wives," *kosio*—that is, women dedicated to his service, who tend the temples, and on holy days and festivals give themselves indiscriminately to the worshipers of the god. The ranks of the *kosio* are recruited by the affiliation of young girls, who are received in a kind of seminary, where they remain for three years, learning the sacred songs and dances and other matters appertaining to the worship. During this novitiate they may only be visited by the priests, but at its termination they practice openly as *kosio*. This is the ordinary mode of becoming a *kosi*; but any woman whatever, married or single, can, by publicly simulating possession by the god, by uttering the conventional cries recognized as indicative of possession, at once join the body. In this case she likewise undergoes a three years' novitiate, during which she is forbidden, if single, to enter the house of her parents, and, if married, that of her husband. The *kosio* of Dañh-gbi usually appear with the bosom smeared with palm oil, but their distinguishing mark is a necklet, called *adunka*, made of the twisted filaments of a sprouting palm leaf. On ceremonial occasions they wear a fillet of the same material, with anklets, armlets, and neck-strings of cowries. The remainder of their costume consists of a strip of cotton print hanging from the waist and barely reaching to the knee. They are most licentious; and the festivals, which are usually kept up all night, present a horrible scene of drunkenness and debauchery. As is the case with the women attached to temples in India, this life of prostitution is not considered dishonorable, because it is regarded as part of the service of the religion. The *kosio* are, indeed, not considered as responsible for their actions. It is the god, say the people, who inspires them at such times.

When a follower of the python-god wishes to have the advantage of his advice and assistance, he has recourse to a priest, who fixes and receives the fees and appoints a day for the ceremony. Such consultations of the oracle, so to speak, are always public. The person seeking the aid or counsel of the god comes with all his relatives and friends; the priest and *kosio* turn out in force and parade the sacred drums and temple paraphernalia; and then, in the open space in front of the temple, the priest becomes inspired and gives vent to the oracular utterances. The indwelling spirit of the python enters the body of the priest and speaks through his mouth, in a strange, unnatural voice. Some honest, though perhaps hysterical, priests really do work themselves up into a condition of frenzy, by means of the violent and extraordinary dance which is always the main feature of such exhibitions; and the dishonest ones, who form the great majority, foam at the mouth and simulate as well as they can the symptoms of an epilep-

tic seizure, which here, as among most other uncivilized communities throughout the world, is regarded as the effect of a god, or devil, having entered the body. It is perhaps needless to say that the oracle is nearly always ambiguous. "If Dañh-gbi be propitious, you will attain your object," is a reply commonly heard. If the applicant should fail, then the priest naturally explains that Dañh-gbi was not propitious; perhaps he had been offended by something, or perhaps the offerings were insufficient; and if he should succeed, then the priest claims the result as being entirely due to the intervention of the god. In this respect, it will be observed, the practice of the Ewe priest does not materially differ from that of the expounders of higher religions. The sacred dance is always performed to the sound of the sacred drums, on which is played a rhythm peculiar to the god. The whole ceremony of "possession" is exceedingly curious, but for further details I must refer the reader to Chapter X of my Tshi-speaking Peoples of the Gold Coast, where will be found a description which applies in all essential particulars equally well to the Ewe-speaking peoples.

The Dañh-gbi we—"House of Dañh-gbi"—or Python Temple at Whydah, which is the most important of its kind, is a circular structure with walls of "swish" or kneaded mud, and a conical roof thatched with grass, a privilege accorded to shrines and temples only, all other buildings being required to be roofed with palm thatch. It stands in a small rectangular inclosure near the center of the town, and around it are the calabashes and shallow earthen vessels containing water, palm wine, palm oil, cowries, fowls, and other offerings. A few sacred trees stand in the inclosure, and long strips of white cotton fluttering from bamboo poles indicate the sacred character of the spot, for white is the color belonging to the vŏdu. The pythons, usually from fifty to eighty in number, live in the temple, but have free exit, holes being made in the mud walls to enable them to pass in and out. They are allowed to wander anywhere about the town, and are only carried back to the temple when they happen to enter some profane locality, such as the yard of a European trader. In such a case a priest goes to fetch the god, prostrates himself before it, apologizes for the liberty he is about to take, and then, raising it gently in his arms, carries it home. When a lay native meets one of these snake deities in his path, he prostrates himself in front of it, rubs his forehead on the earth, and covers himself with dust which he throws on his head and shoulders with both hands. "You are my father—you are my mother!" he cries. "My head belongs to you. Be propitious to me."

Opposite to the Dañh-gbi we are the schools or seminaries where the *kosio* live, and where any child who may chance to

touch, or be touched by, a python has to be kept for an entire year, at the expense of the parents, and learn the songs and dances proper to the worship. In former days adults were similarly liable, especially women; and not even the daughters of influential chiefs were exempt. The scandals that resulted from this—for the *kosio* seminaries are chiefly schools of debauchery—and the decline of the priestly power during the last thirty years, have now, however, led to the penalty being restricted to children.

Fifty years ago any native who killed a python, even by accident, was burned to death; and even Europeans have been killed for having thus offended the religious prejudices of the Whydahs. At the present day, though the appearance of carrying out the old sentence is preserved, the culprit is allowed to escape with life. To keep up the form, he is confined in a small hut made of dried grass, which at a given signal is fired on all sides. The man bursts forth, and is then attacked with sticks by the worshipers of Dañh-gbi, who rain blows on his head and shoulders, until he succeeds in reaching water, which bars him from further attack.

There are days consecrated to Dañh-gbi, when great processions are held, and which are remarkable for many curious ceremonies, too lengthy, however, to be described here. During one procession every house is closed, and the people are forbidden to be abroad in the streets or to peep from their windows; and all processions are ushered in by a general slaughter of all hogs found at large, which are pursued and beaten to death by bands of priests armed with clubs, for the hog is a sacrilegious animal, even capable of devouring a python-god, should he find an opportunity. White ants are the messengers of Dañh-gbi, and their nests may often be seen encircled with palm leaves, to indicate that the inhabitants are in his service. Many people still believe that the traditional python, which turned the tide of victory in favor of the Whydahs, still lives. It is believed to inhabit a gigantic tree hidden in the depths of a vast forest, and to climb every morning to the topmost branch, coil its tail round it, and hang head downward toward the earth. When it is sufficiently long to reach the earth with its head, it will, say the natives, be able to reach the sky and climb up into it.

Such, briefly sketched, is snake-worship, as it exists on the Slave Coast at the present day; and, if we may judge from the descriptions given by old voyagers, it has not changed in any important particular since the downfall of the kingdoms of Ardra and Whydah. Let us now turn to the worship as it is found in Hayti and Louisiana. It will be perhaps more convenient to examine it in detail.

Sir Spencer St. John, apparently following St. Méry, says (p.

186 *et seq.*) that the "Arada" negroes are the true sectaries of "vaudoux" in Hayti, and that the word "vaudoux" signifies an all-powerful and supernatural being, on whom depend all the events that take place in the world. This being only consents to communicate with his worshipers through a high priest, and still more through "the negress whom the love of the latter has raised to the rank of high priestess." These two are called the king and queen. They are the chiefs of the sect, decide who shall be admitted to the society, receive the gifts offered to the god, and, being the interpreters of his will, naturally have great power.

Let us look into this first. As has already been stated, the word vŏdu should not properly be limited to the snake deity, and in Africa Dañh-gbi is not supposed to control the affairs of the world. He is simply the god of wisdom and the benefactor of man, the natural phenomena being under the control of other gods. There is on the Slave Coast nothing answering to the king and queen found in Hayti, but some such change might be expected, for it is improbable that any of the regular priesthood were shipped across the Atlantic as slaves. In the intertribal wars of the present day it seems to be the invariable rule to enslave the masses and to strike off the heads of all chiefs, priests, and men of eminence, whose skulls are carefully preserved, partly as trophies and partly in order that the victory may not be forgotten. From all the evidence now obtainable this seems to have always been the custom; and, as Captain Suelgrave tells us that four thousand prisoners of war were sacrificed at the conquest of Whydah, it is probable that the "classes" were used up in this manner. In Hayti the king takes the place of the Slave Coast priest, and the queen is seemingly the result of a confused recollection of the institution of the *kosio*. In both places the priests are the mouth-pieces of the god, who can only be consulted through them. Of course, this must necessarily be the case wherever there is a priesthood which depends upon the people for a livelihood; for, if any and every individual could consult the gods himself, the office of priest, or mediator between god and man, would be superfluous.

To epitomize further from St. John: In Hayti the reunion of worshipers never takes place except secretly, in the dead of night, and in a place safe from any profane eye. There is an oath of secrecy, which is the foundation of the association. Red seems to be the favorite color, the king and queen wearing handkerchiefs in which it predominates. The snake is present, confined in a box. The meeting commences by adoration of the snake, by protestations of being faithful to its worship and submissive to its commands. Then, those who wish to consult the god, and

ask his aid and assistance in any matter they may have at heart, come forward in turn. The king takes the box containing the snake, and commands the queen to stand on it. "She trembles, all her body is in a state of convulsion, and the oracle speaks by her mouth." Sometimes she promises success, sometimes the reverse; at others she dictates a certain procedure to be followed; generally there is a certain amount of ambiguity in her utterances. After the consultations comes the "vaudoux" dance—that is, the dance proper to the worship. It is performed by the worshipers generally, who imbibe copious draughts of spirituous liquors; and the night terminates in a scene of disgusting debauchery. Those who consult the god bring offerings, and the proper sacrifice is a white fowl or a white goat.

This very closely resembles the proceedings on the Slave Coast. The simulation of possession or inspiration by a god always commences with a violent trembling of the whole body, followed by convulsive movements, during which the "oracle" speaks. White fowls and white goats are to this day the proper offerings to Dañh-gbi at Whydah; and the sacred dance, with its accompanying drunkenness and final midnight debauchery, is what may be seen during any festival. The secrecy which attends the ceremony in Hayti is of course the natural result of the French laws for the repression of the *cult*. Bosman (A. D. 1705) says that red was the royal color at Ardra, which is the probable reason of its being the favorite võdu color in Hayti.

The description given by St. John (p. 191) of the ceremony observed for the admission of a new member to the sect hardly differs at all from what may be seen at the present day on the Slave Coast when a man joins the priesthood. A candidate for the priestly office undergoes a three years' novitiate like the *kosio*, at the end of which time he is required to show, by being publicly inspired or possessed, that some god accepts him and considers him worthy of his service. For this test a circle is traced on the ground, images of the different gods are set at regular intervals round the circumference, and the would-be priest is set in the middle. The drums strike up the rhythm of the sacred dance, and the candidate commences his performance, dances wildly and violently, and then goes through the form of possession, foaming at the mouth and trembling from head to foot. While in this condition he comes in contact with one of the images which surround him, and this indicates the god who has found him worthy. The idea, of course, is that the possessing god causes the candidate to touch the image; and to cross the circumference of the circle without coming into contact with one is a very bad omen. In Hayti the circle is traced, but no images or emblems of the gods are placed round it, because only one god is concerned; there

is no question as to which god the candidate is to serve. Then, too, to leave the circle during possession is equally considered a bad omen.

Võdu-worship in Louisiana does not seem to differ much from the above, except that the office of king has almost disappeared, and that the queen is paramount. In both places it is the worship of the Whydah Dañh-gbi in a disintegrated condition, the disintegration being caused by the disruption of the *cult* from its proper habitat and surroundings, by the repressive measures enacted by the French, which caused new features to appear, by the altered condition of the worshipers, and especially by the disappearance of the established and regular priesthood. Hence a confusion of ideas, which has caused the Haytians to drift somewhat from the true *cult;* but that they know whence they obtained it seems certain, for St. John found in a võdu temple a flag of red silk, on which was embroidered, "Société des Fleurs za Dahomïan." This flag was said to have been the gift of the consort of Soulouque, the Haytian "emperor"; and the fact that such a statement could be openly made and generally believed is significant of the extent to which Haytian society is permeated by this barbarous religion.

One of the most striking results of the confusion of ideas is the grafting of human sacrifices and cannibalism upon the worship of the snake-god, which, in Africa, has no connection with either of these practices. This innovation is, it seems, not universally accepted, for St. John says that there are in Hayti two sects of "vaudoux" worshipers, one of which, perhaps the least numerous, offers human victims and indulges in cannibal feasts; while the other holds such practices in abhorrence, and is content with the white goat and the white fowl, the proper sacrifices of the African *cult.* The Haytians term the sacrifice of a human victim the offering of "the goat without horns," a euphemism for which we can find many parallels. Louisiana is, fortunately, free from this horrible taint, but, from the numerous instances given by St. John, there can be no doubt that the immolation of young people, generally girls, is not uncommon in Hayti. At page 193 he tells us of a scene witnessed by a French priest in the district of Arcahaye in 1869. This man had persuaded some of his parishioners to disguise him as a negro, and to take him to witness the võdu ceremonies All went on in the manner that has already been described till after the sacrifice of a white goat and fowl, when a young man came and knelt before the queen and said: "O maman, I have a favor to ask. Give us, to complete the sacrifice, the goat without horns." The queen gave a sign of assent, the crowd in the shed separated, and there was a child sitting with its feet bound. In an instant a rope, already

passed through a block, was tightened, the child's feet flew up toward the roof, and the king approached it with a knife. The loud shriek given by the victim aroused the Frenchman to the truth of what was really going on. He shouted, "Oh, spare the child!" and would have rushed forward, but he was seized and hurried from the spot by his friends. There was a short pursuit, but he escaped, and, on reaching the town, strove to induce the police to hasten to the place. They would, however, do nothing till the morning, when they accompanied him to the scene of sacrifice, and found the remains of the feast and the boiled skull of the child.

During the government of President Geffrard, a determined opponent of võdu practices, four men and four women were tried and convicted of the sacrifice of a young girl, whose body was afterward eaten by the worshipers. The overthrow of Geffrard was said to have been the result of the measures he took to stamp out these atrocities, and since his time no President, except Boisrond Canal, appears to have had the courage to attack them. According to St. John, these practices are rapidly gaining ground, and are now scarcely even concealed.

The only native god of the Slave Coast whose worship is in any way connected with cannibalism is Khebioso, the lightning-god, who in the eastern districts, abutting upon the Yomba country, is commonly known by his Yomba name, Shango. In bygone days it used to be the duty of the priests and *kosio* of Shango to cut up and eat the bodies of all persons killed by lightning, but at the present day the practice has fallen into desuetude. If the person killed be a freeman, the priests place the corpse on a raised scaffolding of sticks, and, after making all preparations for cutting it up, suffer the relations to ransom it; but where the deceased is a slave, whose body no one would care to ransom, the *kosio* cut from the corpse large lumps of flesh, and chew them, without swallowing, crying to the passers-by, "We sell you meat —good meat." As human sacrifices are frequently offered to Shango, it seems probable that the sacrifice of "the goat without horns," and the subsequent cannibal feast, are really derived from the worship of the lightning-god; and that, owing to the absence of distinct orders of priests in Hayti, the two practices became grafted, by one sect of võdu-worshipers, upon the worship of the snake deity. This view is supported by what St. John says (p. 195) of some curious polished stones, which were shown to him by a French priest, and which formed part of the relics worshiped by the võdu sect. One of these was a stone axe in the form of a crescent, and all implements of the stone age are, on the Slave Coast, sacred to Shango, whose thunderbolts (*sokpe*, "fire-stone") they are believed to be. In fact, whenever a

house is struck by lightning, a mob of priests, *kosio*, and worshipers of Shango rush into it and plunder it, while pretending to search for the sacred stone. When the house is stripped the priests produce a stone implement, generally an axe, which they pretend to have found, and which justifies their pillage. Blood, mixed with rum, is commonly drunk by the votaries of Shango on days of festival; and this is the drink used in the secret ceremonies of the cannibal "vaudoux" worshipers of Hayti.

In the Century Magazine for April, 1886, Mr. George W. Cable mentions some "voodoo" charms; but these have no connection at all with python-worship. They are superstitious practices, such as are found everywhere; survivals of the religions which gave birth to them, and in which each had a definite meaning and intention. Thus, on the Slave Coast, each god has his own distinguishing badge or amulet, made by his priests and sold to his worshipers, who wear them so that the god may be reminded that they are under his protection. From the priests of malevolent gods people can also obtain charms to work evil; and these are either harmless rubbish, such as parrots' feathers tied together, small bunches of human hair, etc., or powders which are reputed to possess magic properties. To keep up the reputation of the efficacy of such preparations, the priests occasionally secretly supplement them with poison, which they contrive to have placed in the food of the person against whom the spell was directed; and the purchaser, finding that his enemy has died, attributes it to the action of what he obtained from the priest, and consequently regards all such preparations with great dread. The hollowed-out acorn, mentioned by Mr. Cable, seems a copy of the cutch-nut charm of the Gold Coast, whose chief use there, however, is to restrain the slanderous tongue; the dough or waxen heart, stuck full of pins, is evidently an idea borrowed from mediæval witchcraft; and the pouring of champagne on a moonless night at the four corners of a square seems a corruption of the form of invocation of Shugudu, a malignant god, who will lend his aid to any one who on a dark night will pour a libation of rum into a hole dug in the ground, or bury a fowl alive.

The different words given by Mr. Cable, as used in connection with võdu-worship, are difficult to identify; they have, no doubt, changed at least as much from the original as the creole French has from European French. As the word *võdu* and the snake-worship are both peculiarly Ewe, one might expect to find words belonging to that language predominating; so, at a guess, one might suppose the words *tigui li*, in the võdu song, given at the foot of page 820, to be *tigewola*, "a maker of charms," or "medicine-man"; and the concluding sentence, *Do sé dan go-do*, to be *Do dsi dañh godo*, "O curved snake, may you be fat," i. e., "have

a good meal." This, however, is mere conjecture, for the word *papa* in the same song, if not French, is the Tshi adjective "good," and not Ewe at all; while the words *Héron mande* defy solution. *Maignan*, or *magnan*, an epithet of the võdu, may be a corruption of *amãga*, "the old, the venerated," or even of *Dañhgbi* itself. I have seen a corruption nearly as bad; that of the Tshi *nyan-kupoñ*, to *accompong*, in Jamaica, for instance. These are, however, evidently words belonging to other languages now mixed up with the võdu *cult* in Louisiana. One such is *wongah*, used in Louisiana to mean a võdu charm, and which is most probably the Gã term *wong*, "a charm." The words in the song *Dé-zab*, at page 827, appear to be Tshi, but I should never have been able to identify them without the translation, "Out from under the trees our boat moves into the open water." By its means, however, "*Day zab, day zab, day koo-noo wi wi. Koonoo wi wi momzah*," may be taken to be really *Des arbres, des arbres, de canoe wiwi. Canoe wiwi miombah*—"From the trees, from the trees, the canoe, stealthily. (In the) canoe, stealthily, let us come." The word *rozah* is unintelligible; in the Tshi language there are no words commencing with *r*, or with that letter with which *r* is so frequently interchangeable, *l*. It would be, however, mere waste of time to look further into this jargon, in which French, Ewe, Effon, Tshi, and Gã words are certainly—and Yomba, Ibo, and Congoese words most probably—indiscriminately mixed together, and so distorted as to render positive recognition almost hopeless.

THE RELATIVE VALUE OF CEMENTS.

By CHARLES D. JAMESON,
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AND
HUBERT REMLEY,
CLASS OF 1890.

IN The Popular Science Monthly of June, 1890, page 253, there appeared an article entitled Natural and Artificial Cements, by Prof. La Roy F. Griffin, in which theories were advanced in regard to the setting of cement which are at variance with the chemical reactions that are known to take place. There were also given the results of some cement tests, with deductions from the same, that not only are contrary to the results obtained by other experimenters, but are also contrary to the results obtained from the use of cements in works of construction. That there are so many points in Prof. Griffin's article to which exception must be taken, and the exceedingly false impression his article would leave upon the public as to the relative value of

American cements, both natural and artificial, is the excuse of the writers for the following article. The diagrams and tables given have been compiled from results obtained in an extended course of cement tests now in progress in the Engineering Department of the State University of Iowa.

Cements, such as are used for constructive purposes, may be divided into two general classes, natural and artificial. The essential ingredients, carbonate of lime, silica, and alumina, are the same in both classes, the principal difference being the proportions in which they are present, and their purity.

In the manufacture of natural cement the raw material generally used is some stone in which the carbonate of lime, silica, and alumina are present in more or less correct proportions, while in the manufacture of the artificial cement the raw material used consists of the essential ingredients, each in a comparatively pure state, thoroughly mixed in theoretically the correct proportions. It is due to this fact that artificial or Portland cement is not only much superior to natural cements, but that it is much more uniform in its quality. This feature of uniformity is perhaps the most valuable possessed by Portland cements, and one which can never be attained in the manufacture of natural cements.

The term Portland cement is now generally used to designate artificial cement, from the fact that the first artificial cement made in England, when hardened, resembled the famous Portland building-stone.

Whether the mixture of the necessary ingredients is artificial or not, it is burned almost to the point of vitrification and then ground to an extreme fineness. The fineness to which cement is ground is one of the most important points in its manufacture, for the reason that, if not finely ground, its strength may be reduced fifty or seventy-five per cent. The theory advanced by Prof. Griffin, on page 254, in regard to the setting of cement, namely, the absorption of carbon dioxide, the uniting of this gas with the lime, and the reforming of lime-stone, is simply the old *lime-mortar* theory, and in no way applies to the setting of cement. In regard to the changes that do take place during the setting of cement, the following quotations from an article upon the subject by Dr. L. W. Andrews and F. W. Spanutius, in The Transit for December, afford the clearest explanations:

"The setting of a cement is, in general, a complex process, partly chemical in its nature, partly mechanical. Broadly stated, the chemical changes which occur may be said rather to afford opportunity for the mechanical changes which result in hardening than themselves to cause the hardening. The chemical changes are, therefore, susceptible of wide variation without materially influencing the result. . . . In some cements, of which

plaster of Paris may be taken as the type, water simply combines with some constituent of the cement already present. In others, of which Portland cement is the most important example, certain chemical reactions must first take place. These reactions give rise to substances which, as soon as formed, combine with water and constitute the true cementaceous material. Portland cement contains as chief, sometimes as almost sole constituent, a lime peridote, and in addition a tricalcium aluminate, $Ca_3Al_2O_6$, soluble in 3,000 parts of water, and a dark-brown fusible substance, $Ca_4Al_2Fe_2O_{10}$. In the act of setting, the tricalcium aluminate first dissolves in water and then begins to separate again as a mass of felted needles consisting of calcium aluminum hydrate, which extend in every direction and are directly the cause of the first setting of the cement. At the same time an action begins which requires a much longer time for its completion, and which probably consists in a combination of the first formed aluminum hydrate with the calcium peridote and the water, forming a mineral belonging to the zeolite class and possessing very probably the composition $H_{10}CaAl_2Si_4O_{17}$. This zeolite crystallizes out as it forms, and this continues, for long periods subsequent to the first setting of the cement, to add to its solidity and tenacity."

Following the reasoning of Prof. Griffin, we are unable to understand the meaning of "pure lime cement," as the two terms "pure lime" and "cement," when used in an engineering sense, are incompatible. The effect of the presence of magnesia upon the quality of cement is not perfectly understood; but that an increased hardening in cement for a long period of time is due alone to its presence, is not so, as cements that contain no magnesia have been known to improve constantly during a period of two years.

To quote from Prof. Griffin:

"So a Portland cement will develop its full strength in a few months, while our natural cements will not for years, and, so long as it (this chemical action) continues, the structure improves."

Unless Prof. Griffin classes Portland cement as a "pure lime cement" (which it is not), he has advanced no proof of the above quotation; and furthermore this statement itself is incorrect. It is a fact well known to all engineers and builders that as a class Portland cements are slower setting than the natural cements; and also that natural cements attain their full strength within a comparatively short time (within the first year as a maximum limit), and that, after the full strength has been attained, this strength may decrease, as time goes on, in some natural cements. There has, however, been found no limit of time beyond which Portland cement deteriorated, and for two or three years at least it improves its strength.

In speaking of cement testing, Prof. Griffin says:

"No one of these" (meaning tests for compression, tension, torsion, and cross-strain) "can be dispensed with, since material that will endure one satisfactorily will utterly fail in another; . . . but for general purposes the test of cement which is the most valuable is that which determines its tensile strength."

There are very few cases in practice where any tests other than for tension are made. The statement that "no one of these can be dispensed with," etc., is contradicted by what follows, that the most general test is for tensile strength.

From the very nature of cement, these necessary qualities are so dependent one upon the other that practice and experiment have shown that, where one of these physical tests is passed satisfactorily, the others within certain limits must also be satisfactory. It is due to this fact alone that tests for tensile strength are accepted as standard, as in construction cement should never be subjected to tension or cross-strain, but is usually subjected to compression, or possibly in some cases to torsion; but because the compressive strength in cement is generally proportional to its tensile strength, tension tests have, on account of the facility and accuracy with which they can be made, been adopted as standard.

The form of the test briquette given by Prof. Griffin is not that approved by the American Society of Civil Engineers and adopted in all standard cement tests. The approved form of briquette is that shown in Fig. 1.

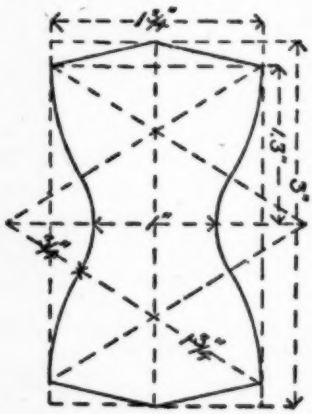

FIG. 1.—STANDARD FORM OF BRIQUETTE, ONE INCH IN THICKNESS.

These briquettes are usually made by hand, as described by Prof. Griffin. But unless a great deal of help is available, the process is much too slow for any very extended series of tests; the amount of mortar that can be mixed at once is small; and where different persons are employed it is impossible to obtain briquettes that give satisfactory comparative results, owing to the difference in the personal equations of the makers. This was soon found to be the case in the "State University of Iowa" cement tests, and a specially designed machine was built, having a capacity of making over three thousand briquettes per day, being run by two men. This made possible the making of a much greater number of briquettes under practically the same conditions. Owing to the greater amount of pressure machine-made briquettes are subjected to (about one hundred and fifty pounds

per square inch), they are probably stronger than the hand-made; but, as this pressure is uniform for all the briquettes, which is not the case when they are made by hand, the comparative value of the tests is far superior to anything attainable by hand-made briquettes. The following table shows the difference in tensile strength between hand- and machine-made briquettes. Each result is the mean of ten briquettes broken at the end of six months:

NAME OF CEMENT.	Hand-made.	Machine-made.
Neat Milwaukee (American)	333	346
" Gibbs's Portland (English)	609	703
" Buckeye Portland (American)	669	844

All the briquettes used in the tests from which the table and diagrams here given were taken were allowed to stand twenty-four hours in the air, and were then immersed, the time of immersion being the zero marked upon the diagrams, and all the periods of time being reckoned from this point in weeks, which are noted along the bottom of the diagram. A number of briquettes were broken each day for the first seven days; after this a number was broken every seven days, and the average of these results giving the ordinates to the line on the diagram. Besides these briquettes, ten extra ones were broken at the expiration of one week, one month, three months, and six months. The average of the tensile strength of these, and the time of breaking, are shown on the diagram by black dots, the letter showing the brand of the cement: M, Milwaukee; U, Utica; G, Gibbs English Portland; and B, Buckeye American Portland. This system of breaking briquettes shows the effect of time upon their strength. The testing-machine used in these tests was Riehle Brothers' "Standard Cement Tester," in which the strain upon the briquette is gradually increased by means of a screw-and-worm gear. Although the type mentioned by Prof. Griffin possesses accuracy, and is very satisfactory, still the Riehle machine gives equally satisfactory results, and allows of a much greater number of briquettes being broken within a given time.

Any comparison of the relative value of cements based upon their percentage of increase in strength, as made by Prof. Griffin, is of no value. A cement that attains a certain strength in seven days, even if it only increases one per cent during the following ninety days, is superior for constructive purposes to one that increases four hundred per cent during the same time, provided the ultimate strength of the latter is not greater than the former.

The strength of Milwaukee cement, of which Prof. Griffin has much to say, can be seen in the diagram, as compared with the other brands of cements given. The table given by Prof. Griffin,

to illustrate the superiority of Milwaukee cement, shows that the strength of the Milwaukee was three hundred and eighty-two pounds per square inch at thirty days, and only three hundred and fifty pounds per square inch at sixty days. This hardly proves either the superiority of Milwaukee, or that natural

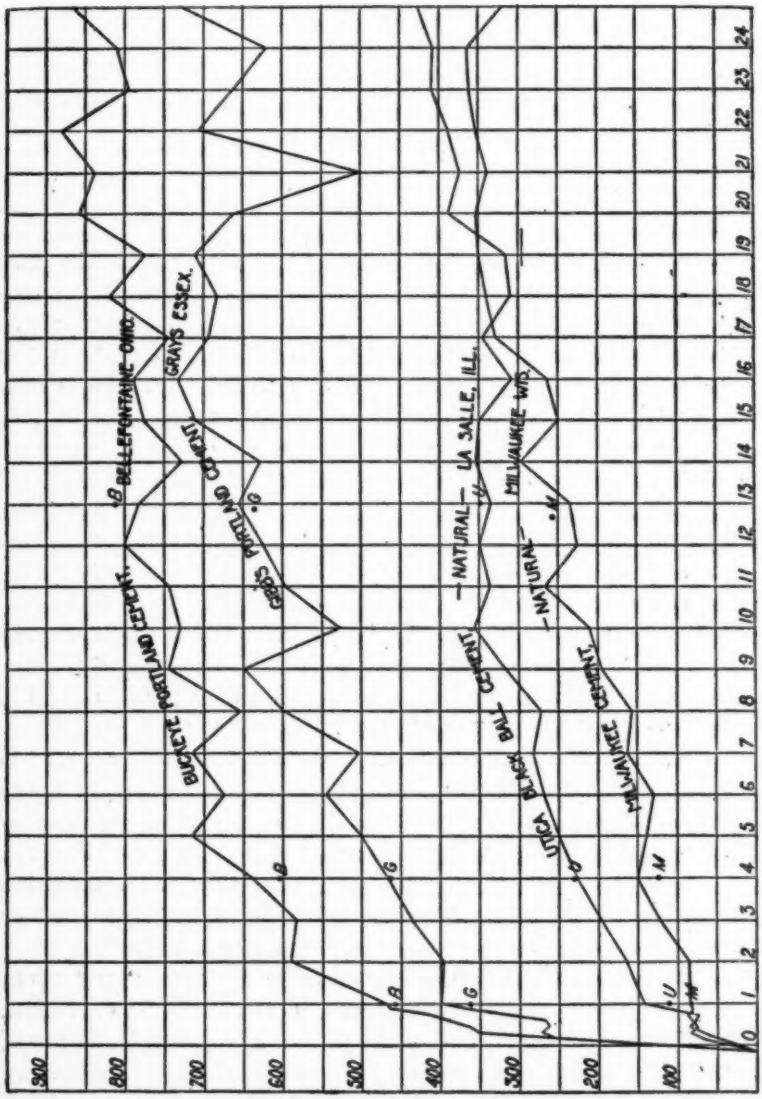

FIG. 2.—DIAGRAM SHOWING THE RELATIVE TENSILE STRENGTH OF ENGLISH AND AMERICAN PORTLAND AND TWO BRANDS OF AMERICAN NATURAL.

cement increases in strength with age; and, as it is the average of seventy-five specimens, would rather seem to disapprove the points mentioned. It is true that briquettes made of the same cement, at the same time, kept under the same conditions, and broken at the same time, show a great variation in tensile

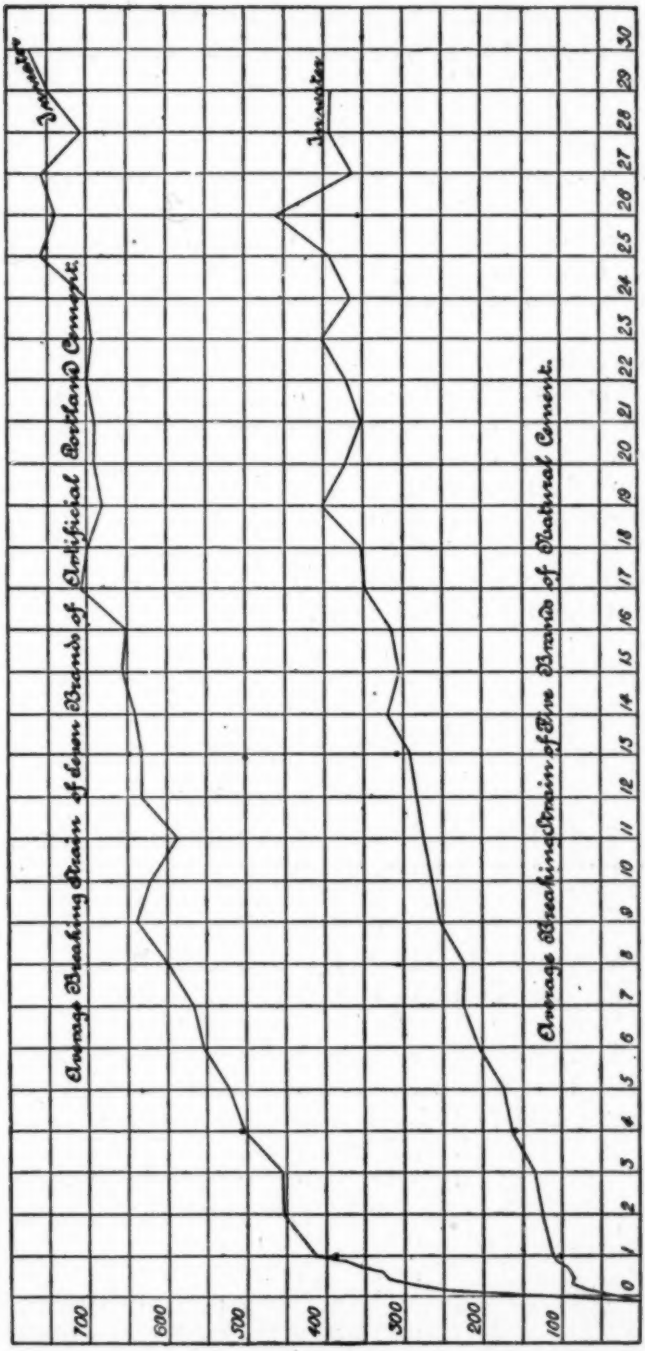

FIG. 3.—DIAGRAM SHOWING THE RELATIVE TENSILE STRENGTH OF NATURAL AND ARTIFICIAL CEMENTS.

strength. The statement of Prof. Griffin that Milwaukee cement has been shown to have the greatest crushing strength is rather too sweeping, to say the least, as all first-class Portland cements are superior to Milwaukee in this respect, and there are a number of brands of American natural cements that are in every way its equal. Although English Portland cements are among the best in the market, still they are equaled by both German and French Portland, while there are now manufactured in the United States Portland cements that in tensile strength exceed any imported cements. Briquettes made of American Portland have shown a tensile strength of eleven hundred pounds at the end of twenty-six weeks.

A careful study of the diagrams will give a correct idea of the relative values of typical English and American Portland cements, American natural cements, and Portland and natural cements. It is not intended to show in Fig. 2 that Milwaukee cement is inferior to all American natural cements, but simply that there are American natural cements that under the same treatment will give at least as good results. The numbers along the bottom of the diagrams indicate the age of the briquettes in weeks; the numbers at the side indicate pounds.

ADAPTATION TO CLIMATE.

By M. SAINT-YVES MÉNARD.*

THE object of the acclimatation of animals and plants is to add to the species, races, and varieties of a country species, races, and varieties of other countries that may be useful or simply agreeable to it, whether they be represented in the wild or the domesticated state. The history of the subject is not complicated. It is a general fact that the sciences which we now have to study before entering into the practice of the arts originated after considerable applications of them had been made. They cultivated wheat long before agronomical institutes were founded; iron was extracted from its ores before metallurgy was known; we took care of the sick—and some pretend that we cured them—before the science of medicine existed. So we domesticated wild animals and took them from country to country, from climate to climate, before we had a science of acclimatization to direct us. But while most of the sciences originated in the distant past, the science of acclimatization is new. Something is indeed said on the subject in the books of Buffon, Bernardin de Saint-Pierre,

* From a Lecture before the Société de Médecine Pratique.

and other authors; and two important acclimatizations—that of the merino sheep by Daubenton, and the introduction of the potato to general use by Parmentier—were made or brought to completion in the eighteenth century, but these were isolated circumstances. The systematic, methodical, deliberate thought of looking out in behalf of any country for animals and plants that might be of profit to it, and of making a study of their value and of the means of making them at home in their new abode, was originally conceived by Isidor Geoffroy Saint-Hilaire. His studies were first directed to this point in 1829, after which they constantly held the most prominent place in his mind. He founded the Society of Acclimatation, for propagating this idea and giving it practical force, in 1854; and five years later, in 1859, in cooperation with that society, he created the zoölogical *Jardin d'Acclimatation* for the purpose of applying the idea to new species, and of studying the conditions under which they could be best made to thrive.

We may divide the history of acclimatation into two periods: one immensely long, beginning with the first domestications of animals and the first migrations of men—a period of practice without science, which was nevertheless fruitful; and the other, which is as yet only a half-century long, of scientific acclimatation. We may also consider the subject with a view to its utility, and to the results that have been achieved in it and the encouragement it offers for the future.

To the first period we owe nearly all our domestic animals and cultivated plants. If we inquire into the origin of our domestic animals, we shall find that twelve of them came from Asia, two from Africa, and three from America, while five are European. If we only had what Europe has furnished us, our list would be reduced to the pigeon, duck, goose, rabbit, and bees. Our farmsteads would then be only modest poultry-yards, and our fields would not be cultivated. It is true that we should not have much occasion to cultivate anything, if we had to leave off from our list of plants all that are not native to Europe. We should be reduced to an unpleasant state indeed if we only had to give up the last imported plant, the potato.

The first importations date from an age long before historic times, and can be determined only from archæological research. The first human inhabitants of Europe, the palæolithic men, had no domestic animals, and depended for their livelihood solely on the natural products of the soil and the fruits of the chase. Centuries after them came the neolithic men, of another race—a pastoral people, bringing with them certain domestic animals. Our knowledge of the kind of life these races lived is only of the vaguest character. But the knowledge of

some contemporary tribes who are still living in the stone ages, and without domesticated animals or plants, will enable us to make a fair comparison between the condition of man before their introduction and that to which he has been able to rise by their aid.

The Fuegians and the Australian aborigines are still living in a condition very nearly like that of primitive man. The only habitation of the Fuegians, cold as is the climate of their country, is the hut of branches, their only clothing is the skin of a fox, deer, or guanaco, which they throw over the right shoulder or over the left, according to which is exposed to the wind. They have no domestic animal except the dog, which assists them in hunting, and is of no mean service to them; for their only weapons are a javelin tipped with a sharp bone, and bows, with flint-pointed arrows. They are, in fact, contemporaries of our civilization, still in their palæolithic age. They are not good fishermen. They gather a few shells on the beach, and an occasional stranded whale furnishes them a royal feast. They eat their food with only the slightest preparation, sometimes throwing their meat on the fire for an instant to bring out its salinity. They have no convenient means of making fire, and, if the supply they try to keep goes out, have to resort to the tedious process of rubbing sticks. Their existence becomes most terrible when storms prevent them from hunting and fishing.

The Australians are, if possible, more savage than the Fuegians, but they live in a hospitable country, the natural flora of which furnishes them some food-supply, and the fauna abundant game. But they have no domesticated animal. Their wild dog is sometimes tamed and trained to hunting, but has not been reduced to a really domestic condition. With no habitation or fixed abode, the Australian sleeps wherever night overtakes him. He has no clothing or feeling of modesty. His arms are a wooden lance, tipped with a kangaroo's tooth, and the boomerang. His food depends on the chances of the chase. When it is abundant, he never thinks of saving it; if it is exhausted, he suffers hunger or turns anthropophagist.

The Eskimos of Greenland are also hunters and fishers. Notwithstanding the rigor of their climate, they enjoy conditions of existence infinitely superior to those of the Fuegians and Australians; and they owe their advantages to two animals—one not domesticated, the seal, which nearly supplies all their wants. It being very plentiful on their coasts, they hunt it so regularly as to be nearly always out of the danger of privations. The second animal, the dog, is domesticated, and, besides being a valuable auxiliary in the chase, serves them as a draught animal.

The Eskimos close their windows with seal parchment; they

warm and light their huts with seal oil; the basis of their food is seal meat, fish and shell-fish only serving to give variety to it; they wear a full dress of seal-skin sewed with seal tendons, with needles of seal bone; their boots are of seal leather, and their baby-clothes are also made of seal-skin; and that substance constitutes the sheathing to their boats. They are able to travel on land, or snow and ice, in sledges drawn by their dogs. With the conditions of existence thus fairly well assured to them, they have proved themselves accessible to a certain degree of civilization, and have been taught to read and write, and to submit themselves to religious restraints. Yet they are liable to sufferings in seasons of extreme severity which they might escape if, instead of the wild seal, they had some domestic animal on which they could depend for the supply of their food and economical wants.

The reindeer is to the Laplander all that the seal is to the Eskimo, and more. It gives him its skin for clothing, its flesh for food, its horns and bones for tool-making. It furthermore gives milk, and is a pack and draught animal. To these it adds the capital advantage over the seal of being a real domestic animal, so that the Laplander is rarely deprived of necessaries. The dog is also an auxiliary. The Laplander has, therefore, two domestic animals. He has made a corresponding advance in civilization beyond what has been accomplished by the Eskimo.

The Spanish conquerors found two countries in America which had a civilization of ancient date—Peru, where there were two domestic animals, the dog and the llama; and Mexico, which, with no domestic animal but the dog, had an advanced and very productive agriculture. Everywhere else the Spaniards found savages, of whom the Caribs were the most famous. These are represented now by the Galibis and other tribes in Guiana, who exist in a primitive condition, without domestic animals. On his second voyage to America, in 1493, Columbus brought over some European domestic animals, which became the property of the Indians who had intercourse with the whites. The half-breeds of these Indians, the Gauchos and the Araucanians, became in less than two centuries pastoral and agricultural peoples, while other tribes, retiring from the whites, fell into a state of decline.

America, poor in domestic animals and having few cultivated plants at the time of the arrival of the Spaniards, from being able to support only a primitive and sparse population, has by the aid of these elements of civilization become populous and wealthy. The same that has been accomplished in America in three centuries has been done in Australia in fifty years.

From this review of primitive life we draw the conclusions that, wherever he may be found, man is condemned perpetually

to a savage and primitive life in a stone age, if he has not command of domestic animals and cultivated plants; from the beginning of human progress comfort of living has borne a relation to the number of domesticated species; and it was by importing their animals and plants, or by acclimatation, that advanced peoples made conquests and colonizations in lands occupied by primitive man. In such cases the natives generally give way before the conquerors.

To the nine animals primarily acclimated in Europe, there were added in the age of the Greeks, by domestication, the goose, bee, and pigeon, and by acclimatation the peacock and the guinea-fowl. In the Roman period the rabbit and duck were domesticated, and the ferret was introduced. After that there were no additions to the domestic fauna till the sixteenth century, when the guinea-pig, American duck, and turkey were acclimated from America. Notwithstanding the small number of acquisitions in this long period, the domestic animals and cultivated plants of Europe were the prime cause of a considerable gradual augmentation in the comfort of the population. They have been brought to a high degree of perfection, corresponding with the growing extent of our wants, and have been subjected to some remarkable modifications, under the new science of zoötechnics; a process of transformation which is still continuous and will never be completed. Species have been divided up to meet the requirements of varied wants, so that one has been made competent to give the service that might be demanded of two, three, and four species. Thus, in horses, we have the riding horse, which can walk, pace, trot, or gallop; the cart horse, which can pull a heavy load at a walk; the stage horse, drawing a lighter load, with a fair degree of speed; and the carriage horse, which travels with speed and elegance of gait. Could the horse have rendered us such a variety of services if he had been left in a wild state? This question is not a gratuitous supposition. The half-wild horses imported a few years ago from the Argentine Republic were of little value, because they had not been fitted, by ancestral training, to perform the various duties required of them.

Instead of increasing the number of species, we have developed varieties within the species, each adapted to a special work. The Laplander has one reindeer, that clothes, feeds, and draws him; we have four or five horses, for the purposes of transportation alone. We have also got animals intermediate between two species.

It is thus found that the material comfort of a people depends much on the animal and vegetable products it possesses, on their variety as well as on their abundance. The variety of animal

and vegetable products depends on the number of domestic species and on the number of specialized varieties within the species.

M. I. Geoffroy Saint-Hilaire had shown, at the time of founding the Society of Acclimatation, that most of our animal and vegetable products had come to us through that process as the prime source. While no one could deny the advantages that had been derived from it in the past, some were skeptical as to its utility in the future. But, as M. Quatrefages has said, man is constantly developing new wants; so that the luxury of the evening becomes the necessity of the morrow. He reminds us that the turkey was first imported as a fancier's bird, and the dahlia as an eatable plant; and I. Geoffroy Saint-Hilaire spoke of the guinea-pig, which the experimental physiologist has found so valuable, as useless.

I begin the list of the recent trophies of acclimatation with the great Australian eucalyptus, a few seeds of which planted in 1856, in Provence, produced good trees, showing that the species could be grown on the Mediterranean littoral. It is now at home in Corsica, Algeria, Italy, and Spain, and is distinguished by the properties of rapid growth, making marshy places sanitary, and having a hard wood impregnated with a peculiar essential oil, the presence of which insures its durability. The industrial cultivation of the bamboo was begun in 1861 in the Basses Pyrenées, under the direction of M. Garique. The plantation of four hectares is now very remunerative. Following M. Garique's example, the Southern Railway Company is using the bamboo to fix the taluses of its embankments and adorn its lines. The military administration contemplates using it also on the taluses of its fortifications, where it will have the further advantage of making the works difficult of access. By cutting the stems on a slanting line the ground can be converted into a tract of stiff, sharp stubble that no one will be able to walk over. This has been done in Tonquin.

The *Stachys affinis*, to which M. Pailleux has given the name *crosnes* as a common name, is a labiate plant, allied to sage and mint, and is cultivated in China and Japan for its eatable tubercles. Specimens of it received by the *Société d'Acclimatation* in 1882 were cultivated by M. Pailleux, who finds that the tubercles, cooked about as beans are cooked, have the flavor of the artichoke, and possess the advantage of offering a fresh vegetable in December, January, and February, when such foods are scarce. Thus, in less than ten years, an edible plant has been imported, experimented upon in cultivation, experimented upon in consumption, and definitely acclimated.

The *soja*, a kind of oleaginous pea from China, which, not con-

taining starch, is an excellent food for persons afflicted with diabetes, was introduced in 1855, and has been the subject of numerous experiments by members of the *Société d'Acclimatation*, and has been most extensively cultivated in Austria-Hungary. It has now become a common agricultural plant. The ailantus silk-worm (*Attacus Cynthia*) was imported from China to Italy in 1856, has been largely multiplied, and has now become so well acclimated that it lives in the wild state. It may thus be found living on the ailantus trees in different parts of Paris. It has not yet, however, been made industrially profitable, because its silk is hard to wind, but a means will be found some day of obviating this difficulty.

The first attempts to naturalize the ordinary salmon (*Salmo salar*) in the waters of southern France in 1886 and 1887 were not successful, because the temperature of the water there was not suited to that species. The introduction of the California salmon (*Salmo quinnat*) by the society in 1888 has been attended with a better prospect of success. The stock, obtained from the United States Fish Commission, is prospering, and will probably be the starting-point for peopling the affluents of the Mediterranean with this valuable fish.

The golden pheasant, originally from China, was imported into England toward the middle of the eighteenth century, and has been much in favor as a cage bird. It has lately acquired an economical value from its feathers having come into fashion as an adornment of clothing, and the cages have been called on to supply them. The sacred pheasant, imported from China in 1866, has multiplied rapidly, with a corresponding reduction in price, and it may now be found wild in the chases around Paris, where no more care is taken of it than of other game birds.

The belief that the African elephant can not be tamed is refuted in the case of Juliette, in the *Jardin d'Acclimatation*, who has borne several young, and is distinguished by the two qualities of strength and docility.

Burchell's zebra, or the *dauw*, although it has not yet been naturalized to our farmsteads, has been seen frequently for several years in the streets of Paris serving as a draught animal. These animals make themselves at home in our stables, behave themselves soberly, and reproduce regularly. Eighteen years of experiment in the *Jardin d'Acclimatation* on eight subjects have shown that they are easily tamed, are susceptible of training, and are capable of displaying much strength in draught.—*Translated for The Popular Science Monthly from the Revue Scientifique.*

LAWS OF GOVERNMENT AMONG THE LOWER ANIMALS.

By J. W. SLATER, F.E.S.

"Positive morality under some form or other has existed in every society of which the world has had experience."—(GROTE's *Fragments on Ethical Subjects*, vol. iii, p. 497.)

WHETHER the author just quoted knowingly or intentionally referred to the societies of the lower animals, as well as to those of mankind, I am not aware. Perhaps, if he had no such intentions, his testimony may be regarded as all the more valuable. Assuredly the ant-hill, the wasp's nest, the rookery, or even the roaming herd of elephants, antelopes, peccaries, or the like, could not cohere, and therefore could not continue to exist as such, without some kind of law and government. Such law, too, must have its foundations laid not exclusively in the physical force of the individual, but in part upon notions of right or wrong, however vague and crude. Absolute personal equality is probably non-existent in any case. Bodily strength plays a part the more prominent the less complex and perfect is the organization of the society. In a herd of bisons, of wild horses, of elephants, or in a troop of baboons, the strongest, generally a male in the prime of life, possesses and exerts a certain supremacy. He holds exactly the same position as does the chief of a savage human tribe; holds it by the same tenure and exercises it in a very similar manner, and subject to the same limitations. That his authority is not absolutely uncontrolled we may learn from a fact to which I shall have to return—the existence of adult males, generally large and powerful, who live in exile.

Among birds the moral life is more highly developed than among mammalia, as we may learn from their being more generally monogamous. Hence, with them, individual superiority sinks very much into the background. The rookery or the heronry seems to form a republic where all are subject to a code of laws which the majority is always ready to put in force against any offender.

The queen bee holds her position by the right of the strongest as against all rivals, and, on the birth or the introduction of another female, she is always bound to do battle to the death for her position. But her sway over her subjects—if such we may consider them—unlike that of the strongest tusker in a herd of elephants, rests nowise upon physical force.

Before speaking of the laws of brutes, we must necessarily first show that they have a perception of duties and of rights. Many facts prove that the lower animals recognize property, and distin-

guish as clearly as do many men between *meum* and *tuum*. When trespassing they plainly know that their quarrel is not just, and conscience makes cowards of many if not of all.

"You are aware," says a writer in the Zoölogist (vol. v, p. 1635), "that in Rome the inhabitants are accustomed to throw out the garbage and refuse of their houses, which is deposited generally in some blind corner appointed for that purpose by the police. Though several hundreds of these depots exist in Rome, not one is unappropriated, but has become the fee-simple of some particular dog, who will not suffer his claim to be invaded. Some cases of copartnership in a corner have been observed, but with brothers on the death of a parent, and desperate battles occur occasionally about 'fixity of tenure,' as in Tipperary."

The homeless dogs of Constantinople have their particular quarters of the city, into which no dog save its regularly established canine inmates can intrude without the risk of being torn to pieces.

A spider, unless greatly superior in size, hesitates to invade the web of another spider for marauding purposes. Ants consider themselves rightfully entitled not merely to the city they have built, and the roads they have laid out, but to the whole neighboring territory, and they will brave any odds in its defense.

I do not assert that among the lower animals right is the only might. Like the "lords of creation" they often covet what is not their own, and, like them, they sometimes overcome the feeling of respect for their neighbor's landmark. There are feathered and four-footed Romanoffs—*Nachbarfresser*—who, without scruple, seek to absorb whatsoever lies in their vicinity. Nor does righteous indignation always lend the assailed party strength enough to defend his Plevna.

We may go yet further: not only do animals feel a right to such possessions as they have acquired by custom, by first discovery, or by labor. Such right, among social species, is recognized by public opinion, and is enforced by positive law. In support of this statement let us turn to the rookery. It has been observed, not once only but repeatedly, that a particular couple of rooks, too lazy to fetch building materials for themselves, and given to plundering their more industrious neighbors, have been formally punished by the community. The penalty inflicted varies greatly. Sometimes it consists simply in a sound beating. Sometimes the ill-gotten nest is summarily demolished, and the materials are given back to their rightful owners. Sometimes, again—perhaps when sundry former convictions are on record—the offenders, after a severe cuffing, are forever banished from the rookery and left to seek out for themselves a new settlement. On one occasion I saw a rook stealthily approach the bottom of a

completed nest and try to remove some of the sticks. But the inmate, reaching over the edge, gave the thief a good peck, whereupon he at once flew away without attempting to defend himself or to retaliate. Similar cases may be witnessed among other species of birds which live in communities.

It may here be pertinently asked whether the laws of the lower animals protect persons as well as property, or whether they resemble the criminal code of England, which imprisons the thief and dismisses the ruffian with a paltry fine—in fact, a retrospective license. In reply, I must point to the "rogue elephants" of India and Ceylon, and to the outlawed buffaloes of South Africa. The gratuitous malignity of these outlaws has been noted by many travelers, and it has been ascribed to their expulsion from the herd. This is confounding cause with effect: they are banished for being quarrelsome and for repeated breaches of the peace.

But to return to the rookery: "crow courts," or crow parliaments" as they are locally called, have been observed in various districts. These are prolonged meetings in which, after much noise, sometimes proceeding from one bird, sometimes from a small number, and then again from the general assembly, a single rook is attacked by the community and put to death. These executions do not seem to be connected with any inroad upon property, since they are not confined to the nesting season, the great time for robberies. There is hence reason to suspect that we have here proceedings for offenses against the person, or against the general well-being of rookdom.

In districts where carrion crows abound, similar trials and executions have also been observed among these bold marauders.

Among rooks, further, laws of a different kind may be traced, the exact purport of which has not been discovered, but which evidently subserve a public purpose rather than the mere regulation of private disputes. For instance, in a grove tenanted by a flourishing rookery, one particular tree, seemingly eligible enough, was never selected for nest-building purposes. If a pair of young birds made the attempt, they were prevented and the foundations of their house regularly removed until they conformed to the custom of their fellow-citizens and built on some authorized tree. In this one case a clew to the proceedings was furnished by accident. A violent storm suddenly overthrew the tree, which, though apparently sound and vigorous, was inwardly decayed beneath the surface of the ground. How the rooks discovered the untrustworthy condition of the tree is a question interesting, indeed, but beside our purpose.

The existence of such laws proves that the rooks have made some advances in civilization, and deem it a duty to protect the

lives of their community even against its own ignorance or carelessness. The prohibition of nests in the unsafe tree is a step toward sanitary legislation.

But there are other instances, instructive in their way, where rooks interfere with members of their own community without any apparent cause. White remarks (Selborne, Observations on Various Parts of Nature), "If a pair offer to build on a single tree, the nest is plundered and demolished at once." This has been repeatedly observed by other naturalists where the trees were quite unexceptionable in point of soundness. Surely these birds, by their conduct in such cases, remind us of certain proceedings of our own species. The rooks who persecute their fellow-citizens who build on unauthorized trees are exactly like human beings who claim a vested interest in their neighbors' speculative opinions, who carry scientific questions to be decided upon in a police court, who dictate what may be discussed and what must be ignored, and who seek to limit the methods of scientific research. Hence the rooks are probably the first animals which have evolved the vice of intolerance. Censorships, anti-vivisection agitations, the imprisonment or execution of discoverers, may thus be traced down the zoölogical series, and may be deemed the ultimate transformation of the tabooed trees near the rookery. In the rooks, as in the *demos* of ancient Athens, as G. H. Lewes pointed out, it is curious that the first distinct manifestation of intolerance should be in a republican community. Perhaps here, as elsewhere, political freedom has to be bought at the price of intellectual and moral bondage.

The laws of ants are probably more complete and intricate than those of the rookery. In the ant-hill the individual is completely absorbed in and subjected to the interests of the community. Cases which seem to indicate sanitary legislation have been observed by Sir John Lubbock and others. Theft in communist societies like those of ants can not occur, and needs, therefore, no repression. Neglect of duty does occasionally take place, and it has been seen to be promptly punished with death. Among the agricultural ants of Texas prisoners have been known to be brought in by a fellow-citizen and handed over in a very rough manner to the guards who are always on duty on the level ground before the city, and who carry the offender into the underground passages. Working ants (Mrs. L. Hutton, Journal of the Linnæan Society, vol. v, p. 217) have been seen to be killed by their companions, apparently as the penalty of inaction.

It is sometimes contended that the divisions of the human species in general, or of any of its races and subraces, into nations, tribes, and clans, is a phenomenon which has no parallel among the lower animals. This view is a grave error. Almost every truly

and permanently gregarious species, as distinguished from such as merely flock together temporarily for some casual purpose, shows plain marks of a subdivision into nationalities. These tribes, by whatever name man may condescend to call them, possess the main features of similar aggregations among the human species. They lay claim to some particular territory; they defend it to the best of their ability against outsiders, and at the same time in a manner truly human they are not unwilling to encroach upon the domains of their neighbors. They have even two distinct moral codes, one to be observed toward fellow-citizens and the other for aliens of their own species.

Nationality among the lower animals shows itself in two very different types. Among vertebrates, the nation, wherever it exists, is composed, as in the human species, of a number of families, monogamous or polygamous as the case may be.

Among the *Articulata*, at least in the only cases where true nationality can be traced—i. e., among insects—the social unit is not the family but the individual. In the case of the hive bee we might, indeed, say that the family and the nation are coextensive. Among ants this is not the case, since in every well-established ant-hill there are several queens, so that the community is not linked together by blood. It may be contended that the absence of the family, viewed as a something which for most individuals has claims stronger than those of the state, is the cause which has permitted the successful organization of communism in insect societies.

Among ants, bees, wasps, etc., the state has no rival. She absorbs all those sympathies and energies which in human society the average individual devotes to the interests of his wife and children.

We thus see that, from their own point of view, theorists on social reform have been logically consistent in attacking the institution of marriage and the entire system of domestic life, though unwittingly they have sought to approximate man to the condition of the ant and the bee. They would form society, not as heretofore of families, but of individuals; or, as it might be expressed in physical language, they seek to build up the community not of *molecules*, but of *atoms!*

But suppose that communism were successful in the abolition of marriage among mankind, would it therefore reach its ideal? Let us look a little more closely into insect life.

It is not enough to show that the failure of communism among mankind and its success among ants and bees are due to the existence and the power of the family in the former case and to its absence in the latter. We must yet inquire into the why and the wherefore of so important a distinction. Vertebrate society,

where it exists at all, is founded on family life, because every normal vertebrate animal is attracted to some individual of the opposite sex by the strongest impulse of its nature, that of self-preservation alone, and not always, being excepted. Invertebrate society where it exists in perfection, as among certain *Hymenoptera*, is not formed of an aggregation of families because the great majority of hymenopterous insects of the social species are neuters, incapable of domestic attachment and devoted to the community alone. To attempt without the existence of neuters to introduce among mankind the social arrangements of the ant-hill is an utterly baseless scheme.

Looking a little further in the same direction, we see that among men there is a wide diversity both in intelligence and in energy. The more highly endowed individual, if he does not leave his children in a better position, materially speaking, is yet likely to hand down to them his own personal superiority. In this manner the equality craved for by theorists is practically annulled.

Among ants nothing parallel can occur. The workers and the fighters are sexless. If any individual is superior to its fellows in strength and intelligence—and certain facts recorded lead us to believe that such must be the case—it has no offspring to whom its gains could be bequeathed or its personal superiority handed down.

Hence the origin of a pariah, a criminal, or a pauper class is prevented. Conversely, the formation of a class *d'élite* is rendered impossible. The ant-hill is, indeed, safe from the existence of the pedagogue and his disciples; but it is, on the other hand, deprived of the thinker, the inventor, and the discoverer.

This is doubtless the reason of the stationary character of the civilization of ants. In proof of this ossification or stagnation, a very interesting fact was pointed out by the eminent Swiss naturalist Oswald Heer. Certain ants belonging to one and the same species are found both in Switzerland and in England. Between the two groups no intercourse can have taken place and no communication can have been transmitted since the "silver streak of sea" was interposed between Dover and Calais—that is, for many thousands of years. Yet on careful examination the social arrangements of these two severed portions, their architecture, and their habits in general, appear identical. Now, had their civilization been undergoing any changes, it is not conceivable that such changes would in both these communities have proceeded at the same rate and taken exactly the same direction. Hence the inference seems plain that in that species of ant progress is at an end.

The brevity of the career of each individual insect acts also

decidedly in favor of the preservation of social equality and of the stationariness of civilization. If either ant or man is apt to rise or to fall, then the shorter the time during which such rise or fall is possible the more surely will a uniform level of society be maintained.

To prevent misunderstanding, I must remark that differences of structure, with a corresponding difference of duties, occur among the workers in the ant-hill; but these differences are not transmissible, and the various classes of workers spring indiscriminately from the same parents. Hence they are not analogous to the castes that have arisen in many human races.

It is noteworthy that man has from time to time sought to imitate the neuter order so prevalent in hymenopterous societies. These attempts, however, whether made by devoting certain classes to celibacy, or by a more barbarous method prevalent in antiquity, and surviving in the East even to our own times, have been an utter failure. Celibates have always proved a disturbing force. What would be the effects, moral and social, of the appearance of a neuter form of the human species, corresponding to the working bee or ant, it is difficult to foresee. We may venture to surmise that they would be disastrous.

But, though communists, ants and bees are not cosmopolitans. A stranger of the same species, but belonging to a different nationality, is far from welcome in the hive or the nest. As a rule, death will be its lot.

Wars not infrequently rage between different hives, or between distinct settlements of ants of one and the same species. According to several observers, though the contending armies are to human eyes utterly undistinguishable, yet each individual combatant never fails to discriminate between friend and foe.

Concerning the government of social insects, we are as yet utterly in the dark. We see works undertaken, altered and extended, criminals executed, guards set, food brought in, nuisances removed, expeditions planned, and wars waged, but we do not see the guiding spirit. Who determines in what direction a body of *ecitons* shall set out on a foray? Who regulates the numbers and the position of the guard found at the entrances of an ant-hill? Who relieves the little sentinels in due course?

In some species there are, indeed, large-sized individuals which seem to exercise a kind of authority, but concerning their powers and duties we know little indeed. If the various functions of a human community were left to the spontaneous initiative of all comers, we should have sad confusion. Now, the various duties to be regularly performed in an ant-hill, if less numerous and multiform than those of a civilized human city, yet seem, to our eyes, to be sufficiently complex to necessite a prearranged system.

A most curious fact in ant-life has been observed by the eminent French chemist, M. Berthelot, who is also a zealous entomologist. He noticed in a little wood a flourishing city of ants which for several successive years went on enlarging its structures and laying out roads in every direction. At last, without any manifest cause, it began gradually to decay. It had not been afflicted by wars, nor by scarcity of provisions; yet the number of its inmates seemed to diminish, their energy and activity faded, and their domes and galleries, no longer kept in repair, took a desolate and ruinous aspect. On the other hand, a colony which the old ant-hill had formerly sent out to a considerable distance was becoming the leading city of the district. What might be the cause of this decay of the mother-city is, of course, very doubtful. Perhaps its inmates had had an attack of what is now called "national conscience." Perhaps in a fit of "magnificent self-abnegation"—a modern synonym for suicide—they had decided that it was selfish to look after their own interests, and decreed that such ought to be allowed to perish. Or, it might be merely an instance of the fact that not merely individuals, but communities, races, and species are mortal—the loss of vitality having its wider analogue in the decay of the tribal instinct.

I have formerly witnessed a very similar case among rooks. A huge ash tree, flourishing in the court of a suburban mansion, and known familiarly as the "crow tree," had been, for a term of years going beyond my remembrance, tenanted by a community of rooks to the extent of perhaps twenty-five to thirty nests each season. At last there set in a gradual falling off. From year to year the number of inhabited nests decreased, and those which were unoccupied fell to ruin or were carried off as building materials. When I last had occasion to pass through the town, only two nests remained in the old "crow tree."

All this time a new rookery had been founded in a park at about a mile outside the town, and thither the former denizens of the tree emigrated. This colony is now much more populous than the old settlement had ever been.

The cause of the "decline and fall" is as mysterious as that of M. Berthelot's ant-hill. The birds had not been in any way molested; their ranks had evidently not been thinned by disease, or the new rookery could not have increased so rapidly.

But, whatever might be the causes in these two instances, we see here another feature in common between human nations and the nations of the lower animals.

It has been observed that even common misfortunes will not compel animals of one and the same species, but belonging to different nationalities, to unite. This fact has come under the notice of elephant-hunters. It has sometimes happened that two distinct

herds of these animals have been surrounded and entrapped together. In such a case, instead of uniting in one grand charge upon the barriers, they keep coldly aloof from each other.

The penalty of banishment occasionally inflicted upon an evil-doer by a community, whether of elephants, buffaloes, or rooks, involves in its very essence the idea of nationality. Where there is no *patria*, there can be no ex*patria*tion. Any group of beings must feel themselves a community before they could inflict exile upon an offending member.

INTERNATIONAL CONGRESS OF AMERICANISTS.

THE International Congress of Americanists was formed at Nancy, in France, in 1875, for the historical, archæological, ethnographical, and linguistic study of the two Americas. Its subsequent meetings have been held successively at Luxemburg, Copenhagen, Madrid, Turin, Brussels, and Berlin. The last, the eighth meeting, was held in Paris, beginning October 14th. M. de Quatrefages presided, and delivered the opening address, which was published in the Monthly for January. French Americanists were well represented among the participants by Lucien Adam, the Comte de Charency, Remi Simeon, Léon de Rosny, Alphonse Pinart, Desiré Charnay, and Dr. Jourdanet; German, by Schoene, Drs. Hellmann, Joest, Seler, Ehrenreich, Grempler, Herr Künne, and Virchow. M. Fabri, now occupying a cabinet position at home, was missed from the Spanish delegation. Members were present from Holland, Denmark, Italy, Switzerland; Dr. Brinton and Mr. H. A. M. Phillips from the United States; Don Ignacio Altamirano, an Aztec, and Dr. Penafid, from Mexico; Señor Manuel de Peralta, from Costa Rica; and others, not named in Das Ausland's account, from other South American states.

The first question discussed was the one, now of several years' standing, of the origin of the name of America. M. Paul Marcou and M. Lambert de Saint-Bris, it will be remembered, had advanced the hypothesis that, instead of being derived from Amerigo Vespucci, who was also called Alberigo, the name is of native origin, and came really from roots which were also represented in the Ameriqui Mountains of Venezuela, Lake Maracaybo, and the region of Amaracapan in Central America. As against this supposition, M. Jimenez showed that the name of the Ameriqui Mountains did not appear on the oldest maps. Other respondents showed that the name of Ameriqui was not known to the official authorities of Venezuela, and that it is written in a different shape (Amerisque) in documents of very modern date. Testi-

mony was adduced as to Vespucci being called Amerigo as early as 1492 and 1495, in the face of which M. Marcou had been compelled to modify his assertions on that point. Dr. Hamy produced the copy of a map made in Malorca, in 1439, on which was marked in an ancient handwriting the receipt of the cost price in gold from Amerigo Vespucci. The Congress with great unanimity approved an observation by Dr. Hellmann that this question should henceforth be regarded as removed from the programme of its discussions. Dr. Hellmann mentioned a document, printed at Lyons in 1546, in which the compiler purposed to describe briefly America, which is also called L'Ameque, "a group of islands of which little is known." M. Gabriel Marcel, of the Bibliothèque Nationale, called attention to a wooden globe in that institution, called "the green globe," which is supposed to have been made in 1513, and is one of the oldest documents on which the name of America appears. On it the land is shown pierced by a strait passing through the heights of Panama, by which it is divided into two large islands.

M. Gaffarel, of the University of Dijon, gave an account of Portuguese voyages of discovery in the Columbian epoch. The fitting out and leading of these expeditions seem to have been monopolized by the Corte Real family; and claims are made that in 1464, or twenty-eight years before Columbus, Johovaz Corte Real discovered the land of Kabuljane—Canada, or Newfoundland. The first voyage authenticated by documents is that of Gaspard Corte Real, in the year 1500, in which he discovered the *Terra Verdex*—Newfoundland, or Labrador. The next year he undertook a new voyage, with three ships, only one of which came back. The report of these voyages is contained in letters of the Venetian ambassador Pasqualigo, and the merchant Alberto Cantino, to the Duke of Ferrara. It is inferred from them that the expedition reached some region in the far north—perhaps Baffin's Bay, or some neighboring water. Venetian beads have been found used as ornaments by the natives of the coast. In 1502 Miguel Corte Real undertook a new voyage, in search of his brother. He also disappeared. The interest of the Portuguese was afterward turned toward Brazil, discovered by Cabral, which was visited by Amerigo Vespucci in 1503.

The sessions of the second day, under the presidency of Señor Altamirano—who was introduced by M. de Quatrefages as a representative of the pre-Columbian races—was devoted to the archæology of America. Dr. Seler presented the last number of the publications of the Berlin *Museum für Volkerkunde*, containing an interesting chapter of the Aztec original text of P. Sahagun, with pictures and descriptions of thirty-six Mexican divinities, translations, and commentary. He also described the wall-

paintings of the palace of Mitla, in red and white, containing many remarkable mythological figures and symbols, which he had copied on the spot, and photographed the pictures.

Desiré Charnay read a long paper on resemblances between the Central American structures and those of eastern Asia, China, and Cambodia, as indicating a derivation of the American race from Asia.

Dr. Seler followed him with remarks on ancient Mexican goldsmith's, lapidary's, and feather work, all of which reached a high condition in that country. We know as yet but little of their methods. The gold was melted up by the Spaniards; most of the feather work—great quantities of which were sent to Europe in the early days of the conquest—has perished by moth-eating, neglect, and dirt. Handicrafts were probably still more extensively carried on in the earlier days of the conquest; but the old chroniclers seldom took pains to give any details on this subject. Exact descriptions can be found only in the Aztec text of P. Sahagun's history. The speaker had copied a large part of two originals in Madrid during the last spring. The ancient Mexican goldsmiths applied gold chiefly—silver only in inlaying—to a kind of linen-lawn fabric. They made cast and hammered ornaments. For casting, a model of the article was carved out of a mixture of fine sun-dried earth and powdered charcoal and covered with a thin wash; or the form was made of clay and coarsely broken coal. Luster was given to the cast object by heating it in an alum bath, and then in a bath of clay mixed with salt. There was a double technic, too, with feather work. In one kind, whole feathers were used. They were stiffened with bamboo and woven together with threads. In this way were many devices fashioned, which the Mexican war chiefs wore strapped to their backs in the dance and in battle. In the other style the feathers were cut up and glued to paper. The feather mosaics, constituting a kind of painting in feathers, were made thus: A ground was formed of the more common, cheaper feathers, and upon it were overlaid brilliant feathers from the *tierra caliente*.

Señor de la Rada y Delgado exhibited a number of ancient Peruvian pieces preserved in the Madrid Museum, that were obtained in the expedition of Ruiz y Paron. He pointed out as particularly characteristic the identity in the form of the utensils of stone and of bronze, and showed a fine bronze axe, which was almost an exact reproduction of the stone hatchet with its string-fastened wooden handle. The handle of this axe is remarkable for its beautiful ornamentation of silver inlayings in the bronze.

The afternoon session of this day was opened by Dr. Brinton with an address in English. M. Eugène Beauvois brought for-

ward for the seventh time his theory, based on the legend of Quetzalcoatl, of a pre-Columbian settlement of America by the Irish. The Marquis de Nadaillac presented the evidence in favor of the population of America in the diluvial period. The Abbé Petitot, long a missionary in British North America, controverted him, affirming that the land was then in the bed of the sea. The Canadian Indians, he said, had a tradition of the world having been overwhelmed by snow. The abbé also told of the creation-myths of the Chiglit Eskimos of the mouth of Mackenzie River, who trace their origin to a giant beaver, living on an island in the western sea. He had two sons. One went eastward to America. From him are derived the Chiglits who wear sticks in their lips. The other went west, to Asia. From him are descended the western Eskimos, called blowers, and, as the Chiglits believe, the Europeans. The island of the tradition was believed to be Bobrovia, or Castor Island, in Bering Sea. The abbé showed a number of utensils of the Mackenzie River tribes and the western Eskimos, which went to confirm, by their resemblance, the tradition of a common origin. M. Raymond Pilet gave some illustrations of the music of the Guatemalan Indians. Not much can be said of their vocal music. For instruments they have a drum and a flute or flageolet, and the *marimba*, which was introduced by the negroes, and can not be called native. Their melodies, as played by the speaker on the piano, had a pleasant sound.

Dr. Deniker gave an account of the results of the French scientific mission to Cape Horn of himself and Dr. Hyades, during which they had spent several years in Tierra del Fuego. They had examined members of three tribes as to their physical peculiarities and differences. Photographs had been brought home of living persons, and prepared specimens of the dead; their dwellings had been photographed, and collections made of their utensils, and the way of using them had been represented as well as possible. These results would all be published in a few months. Dr. Deniker spoke of the voyages, hitherto little known, of Frenchmen to Tierra del Fuego, accounts of which are preserved in the Bibliothèque Nationale. They are those of M. de Beauchesne, about the end of the seventeenth century; of the engineers De Sabat and Du Plessis, who made hydrographic surveys in the Strait of Magellan and along the west coast of South America about the same time; and of the filibuster Jouan de la Guilbaudière, who was shipwrecked in the Strait of Magellan in 1795 and compelled to spend eleven months with the savages. He compiled a vocabulary of more than three hundred words, which is of interest, because it is the earliest collection of Fuegian words we possess. Señor de la Rada y Delgado spoke of the two Maya manuscripts in the Madrid Museum, the Codex Troano and the

Codex Cortes, a paper on the former of which, by Dr. Cyrus Thomas, was noticed in the Monthly for May, 1883. M. Raynaud, Librarian of the Société Américaine, of France, continuing the subject, would distinguish two periods of civilization, one original, generally Mexican, and a later higher, narrower, Yucatecan civilization. Señor Villanova y Piera, Professor of Geology at Madrid, spoke concerning a skeleton which had been found by Señor Carles in the lower deposits of the La Plata region. One of its prominent markings was the evidence of a great wearing away of the teeth by the use of a corn diet.

The fourth day of the Congress was devoted to linguistics; and a number of peculiarities of various languages received free discussion. Remarks were made concerning the geographical name of Central America and the application of the term Anahuac, which Dr. Seler insisted means "the land by the water."

M. Alphonse Pinart submitted two papers on the Antiquities and Rock Inscriptions of the Great and Little Antilles, and the inscriptions on the little island of Aruba, near Curaçoa. The former were ascribed to a pre-Carib population, which the author called the Haytian race. The Aruba inscriptions are very different from those of the Antilles, being cut in the rock, while the others are done in colors. M. Pinart is publishing a series of articles in the Revue d'Ethnographie on the population of the Isthmus of Panama. He distinguishes in Costa Rica the Guetares, civilized inhabitants of the Savannas, living in regular political communities, from the wandering tribes of the eastern forests, the Talamanca Guatusos. The former he regarded as ethnologically identical with the Changuinas of the lagoons of Chiriqui. The same *huacas,* rock inscriptions, etc., are found among both. The Mexicans are a second important element on the Isthmus, and can be found, the author believes, as far down as Chagres and the immediate neighborhood of the line of the canal, and on the Isle of Pearls. But the chief element of the population of the Isthmus, after the Guaymi-Changuinas, is the Cuna, who live on both sides of the territory; a strong, brave nation, fairly well advanced in civilization, living in constant warfare with the Choco Indians, who are in turn under the influence of the highland tribes. They appear to be ethnologically related to the people of eastern Costa Rica. The use of the blow-tube is a peculiar characteristic of the tribes on the Caribbean Sea side of the Isthmus. This paper called out discussion and some dissent.

M. Girard de Rialle read a paper on three treaties concluded in 1666 between the Governor of Canada and representatives of four of the "Five Nations," and the use of totems in the Indian signatures. M. Delisle, of the Museum of Natural History, gave an

anatomical dissertation on the deformities of the skulls of the Chinook Indians. M. Marcele Daly exhibited two large water-color drawings taken by his father, many years ago, of plans of the ruined cities of Copan in Honduras, and Utatlan, the ancient capital of the Quichas, accompanying them with remarks on Central American architecture. Among its peculiarities are the presence of walls in the interior of the temple pyramids, and the thorough painting of the whole. The author considered it remarkable, too, that long houses with rows of columns were usually found near the temple pyramids (or *adoratorios*). Dr. Seler exhibited a number of Aztec manuscripts containing plans of the great Temple of Mexico, on which the long pillar houses were likewise seen near the temple pyramid, and remarked that they were the residences of the priests, as is expressly given out in the Sahagun manuscript. As described by M. Théodore Ber, the ruins of the ancient city of Tiahuanaco are composed of a peculiarly colored granite, which probably came from the "Island of the Sun" in Lake Titicaca, and must have been brought to the site on large rafts. Vessels with a capacity for a hundred persons are still in use on the lake. The author explained that the name of the city means "a dried shore," and discussed the probability of the waters of the lake having once reached to the spot. Among other subjects that were considered in papers and discussion were the attributes, relations, and symbolism of the Aztec war-god Huitzilopochli, by Dr. Seler; Ancient Danish Colonies in Greenland, by Prof. Waldemar Schmidt, who held that the eastern and western settlements were not on different sides of the peninsula, but both on the western side; and Vestiges of a Tiahuanaco Civilization, Aztec Cities, and Aztec Potteries in the Pampas, by Señor Moreno, of Buenos Ayres.

Attention was called by M. de Saint-Bris to the assumed Chinese documents relating to a pre-Columbian discovery of America; but their value was disputed by the Sinologue, Prof. Cordier; and Prof. Gafferal explained, with reference to the alleged pre-Columbian discoveries of the Corte Reals, that the name Antilla in Martin Behaim's globe refers to Aristotle's Antilla, and not to an America known before Columbus.—*From Das Ausland.*

M. J. Roche, addressing the International Telegraphic Conference in Paris, recalled some of the objections that were made to the electric telegraph when it first went into practice, as being of historical interest, and as illustrating the extent to which the fear of the new controls the world. Berryer said that the wires running along the railways would cause accidents to the engineers, and with the posts would offer unpleasant sights to travelers; Pouillet said that the expense would be ruinous and without practical results; and that the invention, though an ingenious one, would not displace the old way of telegraphing.

SKETCH OF SAMUEL LATHAM MITCHILL.

THE name and fame of Dr. Samuel L. Mitchill have, in the absence of a complete biography, become to a considerable extent a tradition, known to few except students; yet, during the first quarter of this century, he was one of the most conspicuous figures in the literary and scientific life of the United States. He is called by Dr. J. W. Francis "the Nestor of American science," and "the pioneer philosopher in the promotion of natural science and medicine in America." He was a man of various attainments, and proved himself at home in many fields—in medicine, science, letters, politics, and social life.

SAMUEL LATHAM MITCHILL was born in Hempstead, Long Island, August 20, 1769, and died in the city of New York, September 7, 1831. He was the third son of Robert Mitchill, an industrious farmer and member of the Society of Friends, and was remarkable for his habits of observation and reflection. His father seems to have taken less interest in his early instruction than his maternal uncle, Dr. Samuel Latham, of North Hempstead, who assisted him to obtain a good classical education. He afterward studied medicine with Dr. Latham; then with Dr. Samuel Bard, of New York; and in 1783 went to complete his studies in the University of Edinburgh, whence he was graduated in 1786. He enjoyed here rare advantages of intellectual society, and had among his contemporaries at the university such illustrious men as Sir James Mackintosh and Thomas Addis Emmet, Dr. Caspar Wistar, Richard S. Kissam, the surgeon; and William Hammersley, afterward a professor in Columbia College. After graduation, and before returning home, he made a pedestrian tour through a part of England. In 1787, after his return to America, he visited Saratoga Springs while it was surrounded by the forest, and ascertained experimentally that the gas extricated from the water was "fixed air, with the power to extinguish flame, destroy the life of breathing animals, etc." He is found in 1788 recording his walking with congenial companions "in the very grand procession for celebrating the adoption of the Constitution of the United States." He began the study of law with the Hon. Robert Yates, Chief Justice of the State of New York, and was shortly afterward appointed one of the commissioners to treat with the Five Nations for the cession of the "Great Western District" to the State of New York. He attended the council at Fort Stanwix, witnessed the deed, and received names from the Oneidas and Onondagas.

In 1790 Dr. Mitchill was chosen a representative from Queens County in the New York Legislature. In the next year he exerted

himself to form the North Hempstead Library Association and Library. In 1792 he was appointed Professor of Chemistry, Natural History, and Philosophy in Columbia College, where, while dissenting from some of the principles of the French chemist, he introduced, for the first time in the United States, the chemical nomenclature devised by Lavoisier. His dissent from Lavoisier led to a controversy with Dr. Priestley, at the end of which the two disputants found themselves on a footing of mutual esteem and warm personal friendship. He records himself in 1794 as having exhibited at full length, in a printed essay, the actual state of learning in Columbia College. At about this time, too, he was co-operating with Chancellor Livingston and Simeon De Witt in the establishment of the Society for the Promotion of Agriculture, Manufactures, and the Useful Arts, before which he delivered his first public address. Having executed a commission from this society for that work, he made a detailed report, in 1796, of geological and mineralogical observations on the banks of the Hudson, for coal, etc.—a performance which, he mentions, was respectfully quoted by Count Volney. This was the first work of the kind undertaken in the United States, and the report helped to secure a wide European as well as American reputation for the author. Referring to it, Dr. J. W. Francis says, "He may fairly be pronounced the pioneer investigator of geological science among us, preceding McClure by several years." The report was published in the Medical Repository, a quarterly magazine begun in 1797 by Dr. Mitchill, with Drs. Edward Miller and Elihu H. Smith, and continued by Dr. Mitchill for more than sixteen years.

After his marriage, in 1799, to Mrs. Catharine Cock, which brought him the enjoyment of an ample fortune, Dr. Mitchill was able to devote himself entirely to scientific and public occupations. Among the scientific works with which he accredits himself during the few years succeeding this event is the publication of a chart of chemical nomenclature, with an explanatory memoir, in which he contended that metals in their malleable and ductile state are compounds of a base with hydrogen (phlogiston), as in their calciform state they consist of a base with oxygen; and that in several there is an intermediate condition in which there is no union either with hydrogen or oxygen. And he extended the same doctrine to the greater part of inflammable bodies. In 1802 he records a correspondence with Albert Gallatin, Secretary of the Treasury, on a project for illuminating the lighthouses of the United States with inflammable air. In 1806 he wrote the introduction to the American edition of Assalini's Observations on the Plague, Dysentery, and Ophthalmy of Egypt; and in the ensuing winter translated from the Latin Lancisi's book on the noxious exhalations of marshes at Washington—a

work which was afterward printed in the Medical Repository. As a member of the Legislature, he supported, in the face of ridicule and opposition, the act of 1798 giving Livingston and Fulton the exclusive right to navigate the waters of New York by steam. He performed, with Fulton, in August, 1807, the first voyage in a steamboat. He was again chosen to the Assembly in 1797 as one of the representatives from the city and county of New York for a term of service which he marked as distinguished by his introduction of a motion relative to the sixth commandment, requiring citizens to labor on the six days as well as to refrain from labor on the seventh day. In 1801 he was elected to the national House of Representatives, as member from the district consisting of the counties of Kings and Richmond and the city and county of New York. He was appointed to the Senate in 1804, to fill the vacancy caused by the resignation of John Armstrong, and after the expiration of his term there, in 1809, served in the House again till 1813. A bright picture of his life in Washington is given in the letters written by him to his wife during his term of service, a selection from which was published in Harper's Magazine in 1879. They are full of the life of the politics and the society of the capital, and the telling of the incidents is made more attractive by the writer's always lively humor.

The lines of Dr. Mitchill's work in Congress are indicated by various notes in his letters and in the record which he has left of Memorable Events and Occurrences in his life. During his first term he was a member of committees of the House on Commerce and Manufactures, the Naturalization Laws, the protection of American seamen and commerce against the Tripolitan corsairs, Naval Affairs, memorials concerning perpetual motion, Patent Rights, the Mint, and French spoliations. He labored in the Senate for the adoption of improved quarantine laws, "and was strenuous," says Dr. Francis, "to lessen the duty on the importation of rags, in order to render the manufacture of paper cheaper, the better to aid the diffusion of knowledge by printing." In December, 1811, he brought up for adoption by the House of Representatives a report favorable to the "nascent nations" of Spanish America, and "full of good wishes toward them in their exertions to become free and independent." In connection with the War of 1812 he acted as a commissioner under the Navy Department in constructing a floating battery or heavy vessel of war, to defend the sea-coast and harbors of the United States; and in 1814 he was found laboring jointly with his patriotic neighbors, "with mattock and shovel, in the trenches for several days, to erect fortifications against the enemy."

National and social matters did not absorb Dr. Mitchill's attention in Washington to the exclusion of his interest in scientific

inquiries. Curious speculations and remarks appear in his letters about phenomena which came under his observation. In one letter, Dr. Mitchill wishes his wife to inform him exactly at what hour a certain storm began. "I wish to know," he said, "exactly when the storm began in New York, as it is connected with other facts tending to a theory of the atmospheric motions in winter." Another letter, forwarding a specimen of the *Mitchella repens*, explains why no plant had been named after him. Prof. Willdenow, of Berlin, had intended to give his name to some plant, but found it already appropriated by this partridge-berry, which was named by Linnæus in honor of John Mitchell, of Virginia. He was more fortunate, according to Dr. Francis, in the matter of fish. "He was the delight," says this biographer, "of a meeting of naturalists. The seed he sowed gave origin and growth to a mighty crop of those disciples of natural science. He was emphatically our great living ichthyologist. The fishermen and fish-mongers were perpetually bringing him new specimens. They adopted his name for our excellent fish, the striped bass, and designated it the *Perca Mitchilli*."

He writes concerning a conversation he had with Captain Lewis, the explorer, about the burning plains up the Missouri, where the burning strata of coal underlying the plains produced such intense heat as to form lava, slag, and pumice-stone by the same process that forms those volcanic substances in the burning mountains of other countries. December 30, 1807, he congratulates his wife on the account in one of her letters of the meteoric stones that fell to the earth in Connecticut, which arrived at a most convenient time, having preceded all the letters to the Connecticut delegation, and even outrun the newspapers. Dr. Mitchill also during this period visited Upper Canada, and described the mineralogy of Niagara Falls; wrote a history of West Point and the Military Academy; and visited Harper's Ferry and described the geology and scenery of that spot, which had been eulogized for its sublimity by Jefferson in his Notes on Virginia. Dr. Mitchill retired from his professorship in Columbia College on his election to Congress, in 1801. In 1807, when the College of Physicians and Surgeons of the City of New York was organized, he was chosen its first Professor of Chemistry, but declined the position, preferring his public duties. In 1808, however, he accepted a professorship of Natural History; and in 1820, on the reorganization of the faculty, became Professor of Botany and Materia Medica. Difficulties occurred with the Board of Trustees in 1828, and the whole faculty of the college resigned. Among other works for the advancement of science and learning mentioned in his record are his action with Drs. Hosack and Hugh Williamson in laying the foundation of a Literary and Philosophical Society

in New York, in 1815; the reading to the society of a narrative of the earthquakes of the United States and in foreign parts, during 1811, 1812, and 1813; co-operation in a petition to the Common Council of New York for the grant of the building in the North Park for the purposes of Literature, Science, and Arts; the delivery, in connection with a curious case by which the town was stirred, of a public lecture on the Somnium, or dream, as a state different both from wakefulness and sleep; an excursion with friends to the region watered by the Wallkill, where the party disinterred a mammoth; participation in an excursion to the Neversink Hills, near Sandy Hook, where a dangerous mistake in their altitude, which had been supposed to be six hundred feet, was corrected, and the real height was found to be only half as great, or three hundred feet; acting as vice-president of the District Convention which met at Philadelphia for preparing a National Pharmacopœia; and co-operation with Samuel Wood and Garrett K. Lawrence in recommending the willow-leaved meadow-sweet (*Spiræa salicifolia*) "as an admirable article for refreshment and health, and as a substitute for the tea of China." A description and classification of one hundred and sixty-six species of fish, chiefly found in the fresh and salt waters adjacent to the city of New York, which he offered to the Literary and Philosophical Society at one of its earlier meetings, was the nucleus of what is regarded as his chief work. He mentions in his record more than forty additional species described in Bigelow and Holly's Magazine, and several more in the Journal of the Philadelphia Academy of Sciences. An elaborate History by him of the Botanical Writers of America is to be found in the collections of the New York Historical Society. Of his literary and scientific work as a whole, in fact, it is well said in the Cyclopædia of American Literature that numerous papers by him are included in the Transactions of the many learned societies of Europe and America of which he was a member; and he was often called upon, at the anniversaries of the societies of his own city, to appear as their orator. "His multifarious productions are consequently scattered over a number of publications and collections of pamphlets, and are somewhat overshadowed by the reputation of the learned bodies with which they are connected. They have fallen, to some extent, into an unmerited oblivion." He had committed his manuscripts to his brother-in-law, the late Dr. Samuel Akerly, as the friend most competent to write his biography, and the work was begun, when the papers were destroyed by the burning of the house in which they were deposited. Had Dr. Akerly not been thus prevented from completing this work, and had he been able to present Dr. Mitchill's life and writings in substantial form, the subject of our sketch would doubtless have received the credit to

which he was entitled, and have been made to appear as one of the most vigorous leaders of early American science.

The scientific items in Dr. Mitchill's record are continued with mention of the introductory lecture to the College of Physicians, etc., on the life and writings of their late president, Samuel Bard, 1821; a philosophical discourse in St. Stephen's Chapel, Bowery, to the class formed in that congregation for cultivating the natural and physical sciences, 1822; a discourse on the Life and Writings of Linnæus, at Prince's Botanical Gardens, Flushing, on the anniversary of the Swede's birthday in 1823; and the publication of a catalogue of the geological articles and organic remains which he presented to the museum of the Lyceum. In 1823 he appears as performing, after the Venetian example, on an invitation from Albany and a mission from New York, the ceremony of marrying the Lakes to the Ocean, at Albany, "on the day of the unprecedented gathering of the people to witness the scene of connecting the Western and Northern Canals with the Hudson"; and again, two years afterward, as a member of a committee for celebrating the completion of the Western Canal, when, in the vicinity of Sandy Hook, he pronounced an address "on the introduction of the Lady of the Lake to the estate of her spouse the Lord of the Ocean." This, according to Dr. Francis, was the proudest day of his life. He also acted on a committee, in 1824, to receive funds in aid of the efforts of the Greeks to achieve their independence.

Dr. Francis says, summing up his work, and quoting at least a part of the estimate from the book, Old New York, that "the universal praise which Dr. Mitchill enjoyed in almost every part of the globe where science is cultivated, during a long life, is demonstrative that his merits were of a high order. . . . His knowledge was diversified and extensive, if not profound. His first scientific paper was an essay on Evaporation. His mineralogical survey of New York, in 1797, gave Volney many hints; his analysis of the Saratoga waters enhanced the importance of those mineral springs. . . . His ingenious theory of the doctrine of septon and septic acid gave origin to many papers and impulse to Sir Humphry Davy's vast discoveries; his doctrines on pestilence awakened inquiry from every class of observers throughout the Union; his expositions of a theory of the earth and solar system captivated minds of the highest qualities. His speculations on the phosphorescence of the waters of the ocean, on the fecundity of fish, on the decortication of fruit trees, on the anatomy and physiology of the shark, swelled the mystery of his diversified knowledge. . . . His researches on the ethnological characteristics of the red men of America betrayed the benevolence of his nature and his generous spirit. . . . He increased our knowledge of the vegetable materia medica of

the United States, and wrote largely on the subject. . . . He largely seconded the views of Judge Peters on gypsum as a fertilizer. . . . His letters to Tilloch, of London, on the progress of his mind in the investigation of septic acid—oxygenated azote—is curious as a physiological document. . . . He was associated with Griscom, Eddy, Colden, Gerard, and Wood in the establishment of the Institution for the Deaf and Dumb; and, with Eddy and Hosack, may be classed with the first in this city, in respect to time, who held converse with the afflicted mute by means of signs."

It would be difficult, says an article in Harper's Magazine for April, 1879, for those who never saw Dr. Mitchill, "to conceive the deference paid to his learning and judgment. His knowledge of the physical sciences, his varied and intimate acquaintance with classical literature, both ancient and modern, his attainments in history and political science, his practical acquaintance with public affairs, and his remarkable affinity with the common and useful arts, caused him to be looked upon as a fountain of learning always ready to pour forth abundant streams of knowledge to every thirsty applicant. A witty friend once said of him, 'Tap the doctor at any time, he will flow.' Accordingly, the merits of all inventions, discoveries, projects, arts, sciences, literary subjects and schemes, new books and publications, professional cases, acts of charity or public spirit, and a multitude of other things, used to be submitted to his critical opinion. If he had not been one of the most polite and amiable of men, he could hardly have borne the demands thus made upon his time and patience." Dr. Francis relates that, being present at his funeral, he stayed till all but the sexton had gone, and then asked, unrecognized by him, whom he had just buried. "A great character," the man answered, "one who knew all things on the earth and in the waters of the great deep." Dr. Francis is also authority for the story that when the purchase of the Elgin Botanic Garden by the constituted authorities was argued at the Capitol, "he won the attention of the members by a speech of several hours' length, in which he gave a history of gardens and the necessity for them. . . . With his botanical Latinity occasionally interspersed, he probably appeared more learned than ever. Van Horne, a western member, was dumfounded at the Linnæan phraseology, and declared such knowledge to be too deep for human powers to fathom."

As described by Dr. Francis, Dr. Mitchill's appearance before his class in the instruction-room was that of an earnest instructor, ready to impart the stores of his accumulated wisdom for the benefit of his pupils, while his oral disquisitions were perpetually enlivened with novel and ingenious observations. Chemistry, which first engaged his capacious mind, was rendered the more

captivating by his endeavors to improve the nomenclature of the French *savants*, and to render the science subservient to the useful purposes of agriculture, art, and hygiene. In treating of the materia medica he delighted to dwell on the riches of our native products for the art of healing, and he sustained an enormous correspondence throughout the land, in order to add to his own practical observations the experience of the competent, the better to prefer the claims of our indigenous products.

Many of Dr. Mitchill's scientific papers were published in the London Philosophical Magazine, New York Medical Repository, American Medical and Philosophical Register, New York Medical and Physical Journal, American Mineralogical Journal, and Transactions of the Philosophical Society of Philadelphia; and he supplied several other periodicals, both abroad and at home, with the results of his cogitations.

Dr. Mitchill was the author of a few verses, and of prose essays or addresses of an order of humorous trifling, much affected at the time, of which the lighter works of Irving and Paulding furnish the most conspicuous examples, and with which Halleck's verses are in sympathy. One of his favorite topics was a proposition to give a new name—Fredon, or Fredonia—to the United States, after which the people should be called Fredes or Fredonians, and their relations Fredish or Fredonian. The subject was taken up and discussed in the New York Historical Society, but has long since been forgotten.

His social and domestic character, according to the writer in Harper's Magazine, was unusually amiable and attractive, and marked by many amusing peculiarities. He had great fondness for young people, and a rare power of inspiring them with the love of knowledge. His home was pleasant and unpretending, "and the numerous celebrities who used to resort to his *salon* were entertained with cordial but simple hospitality." His house was a perfect museum of curiosities, and Mrs. Mitchill used to be troubled by the disorder they occasioned. As pertinent to this nuisance, the story of the ant-eater's skin was told. At first the skin was an object of great interest. Then it became dingy and dusty, and was remanded to the garret. In two or three years more it became old and moth-eaten, and Mrs. Mitchill and the servant, not wishing to worry the doctor, had it secretly carried off and thrown into the street. Dr. Mitchill, taking his regular walk the next morning, came upon a group of boys curiously looking at some unusual object, which proved to be the ant-eater's skin. He joined them, and, after giving them a full scientific lecture on the ant-eater, said he had a skin like this one at home and would be glad to have another—and bought it from them for fifty cents. No further attempts were made to get rid of it.

CORRESPONDENCE.

A DEFENSE OF THE ARCHITECTS.

Editor Popular Science Monthly:

SIR: Mr. Barr Ferree's articles on modern architecture, in the June and December numbers of the Monthly, are interesting as giving an outside view of the present condition of that profession; but the writer fails to discriminate between past performance and present tendency, between evils in the ascendency and evils on the decline. He appears, indeed, quite uninformed as to what is being done by our leading architects and as to the spirit and methods of their work, and judges the architecture of our time by its worst instead of its best performances. The views he expresses are more or less widely prevalent in the community, and now that they have found such pointed and vigorous utterance, demand that some one should call attention to the fallacy of a part, at least, of their assertions. Architects are not such unwilling listeners to lay criticism as this writer would have us believe, but they do ask that it shall justify itself by clear definitions, precise statements, and evidence of thorough acquaintance with the various bearings of the subject. These are to be looked for in vain in the above-mentioned articles, which, moreover, seem to ignore the progress made by the profession in the last twenty years (in house-planning, for instance, in which the work of our architects has aroused wide-spread interest even among the conservative French). Both articles attribute to architects as a class a disregard of sanitary and mechanical requirements quite unwarranted by the facts, and deprecate the attention they pay to exterior design, although most critics find this the weakest side of their work. They are written in apparent ignorance of the fact that it is to the architects that we owe in great measure our municipal building laws and a large part of the modern advance in scientific construction and in sanitation applied to building. The strictures in these papers appear to be based on reading rather than on careful observation. Their author follows hard after Ruskin in his apparent hatred of the Renaissance, and the last part of the Fifth Discourse in Viollet-Leduc's Entretiens sur l'Architecture would seem to have furnished a large part of the ammunition for his December assault; but the Entretiens were written seven-and-twenty years ago, and the evils at which they were aimed, however prevalent in France at the time, and however characteristic even of our own architecture twenty years ago, are not fairly characteristic of it now. The article in question is out of date; it is a quarter of a century behind the times.

It is practicable here to notice only in a summary way the erroneousness of its main contentions. The grain of truth in them need not be denied. That there are charlatans and ignoramuses among the architects of our day is as true as it is of the legal, medical, or clerical profession, or of any other class of men following a common pursuit. It may even be admitted that among them are to be found not a few men of intelligence and culture who are pursuing their career along mistaken lines or without sufficient technical training; but from this to the denial of the existence of intelligence or conscience in the profession is a long distance across which one should not attempt to leap without looking. Is it indeed true that charlatanry and ignorance control the profession and give it its character? Is it true that architects generally subordinate common sense to caprice? Is it true that when a client comes with a rational, well-considered, and practical programme for a given building, the architect generally disregards his wishes and fools him out of his programme by pretty pictures intended only to catch his eye and a commission, or that in the average work of representative architects the demands of exterior ornamentation alone dictate the interior planning? Is it true that our architects have signally failed to avail themselves of modern progress in scientific construction? Is it not rather true that they have, on the contrary, often been the pioneers in the introduction and development of new materials, appliances, and building processes? It is certainly a mistake to assert that Roman architecture paid no attention to exterior effect, and did not largely avail itself of the splendor of internal adornment by applied ornament It was subject to the changes of "fashion," and its forms are largely the product of a change of fashion following the conquest of the Greek world. The like is true of many phases of Gothic and other historic styles.

The contentions of the articles under consideration need only to be stated in the plain and concise form of these queries and denials to appear to every well-informed and fair-minded student of our architecture an almost grotesque caricature of the true state of affairs. Their effect, in view of the reputation of the magazine through which they have been given to the public, can only be to foster existing prejudices, however vague and unfounded, against architects as a class, and to impede instead of helping

on the reform of our architecture. It is hardly too much to ask that writers on the state of modern architecture will, before pronouncing absolute condemnation, make the acquaintance of our leading architects, visit their offices, study their methods, familiarize themselves with the great difficulties and amazing complications of the architectural problem, and carefully examine the efforts which these men are making for its satisfactory solution.

Yours, etc., A. D. F. HAMLIN,
Adjunct Professor of Architecture,
School of Mines, Columbia College.

NEW YORK, *December* 17, 1890.

NEW ENGLAND AGRICULTURE.

Editor Popular Science Monthly:

SIR: I have just been reading Prof. Currier's article on The Decline of Rural New England. It does not in any degree satisfy me as an exposition of things as they are. Like him, I was born close to the soil; like him, I have been and am a student; but, unlike him, I am now, and have been for most of my life, a practical farmer. My diagnosis of the case is (consequently) quite different. I agree with him only in thinking that our tariff laws have generally done the farmer more harm than good. He utterly ignores the chief of all the reasons why farming has declined, so far as a decline can be noted. This decline is in the hill-farms chiefly, and it has been coincident with the opening up of Western free lands. But it has also been coincident with a great decline in the fertility of those farms, with no corresponding increase among the farmers of knowledge how to prevent such decline, or how to restore lost fertility.

The comfort and prosperity of the earlier generations of our farmers are exaggerated. There was as much debt, as little general advance, and very much more vice among New England farmers fifty years ago than now. Prof. Currier makes the common mistake of comparing the valley farmers of fifty years ago with the hill farmers of the present day. By the enforcement of prohibitory laws, and the general reprobation of intemperance in the rural districts of New England, the moral condition of the hill farmers has been, on the whole, much improved, and their manner of life—their civilization—much advanced. But, in the mean time, for lack of instruction, their lands have become infertile to the degree that they fail to give them a good living; while free farms in the West have been made so cheaply accessible to them that they have sold out and gone away. This is the whole explanation of what has been and is called the "decline of New England farming." The census does not reveal any real decline. The value of the agricultural products of New England is still as large, per acre and per man; while compared with other sections New England yet stands with the best States, even without allowance for the natural inferiority of much of her soil. "Plenty of food, plenty of children." As the fertility of the hill-farms disappeared, so came the decline in the size of the families on them. Is this only a coincidence? I think not; although I admit an equal decline elsewhere, from different causes.

If religion has declined among our people, there has been no accompanying decline of morality. The ministers have lost much of their influence, chiefly because they have been educated away from the people. In my youth the rural ministers were among the best farmers we had. Now, I do not know in a whole county a minister who takes any interest in agriculture. A farming ministry would be a great help to New England agriculture, and equally to moral social life. But our classical schools and colleges all educate away from the farm and from sympathy with the plain people. Our rural ministers are almost to a man the outspoken foes of science, as being destructive to the dogmas upon which their religious systems are built.

The hill-farms in New England are "played out." Many of them are going back to forest, which is perhaps their best use. But one has only to take a carriage trip through our river valleys to see abundant signs of agricultural progress and prosperity. Not that even our valley farmers have not their "ups and downs"—their years of bad as well as of good times—but they and their families live better, have more, and enjoy more, much more, than did their fathers and grandfathers. They are better educated; and many of them, and of their families, are careful readers and students of their art, as well as interested in the general progress of the world. Their great need is for better schools, in which scientific instruction should have the first place. The old literary methods, though still supported by the college and seminary bred clergy, are obsolete, useless, and prejudicial to the advance of true civilization and the industrial arts, especially the art of agriculture. T. H. HOSKINS.

NEWPORT, VT., *January* 10, 1891.

EVOLUTIONARY ETHICS.

Editor Popular Science Monthly:

SIR: Some of the difficulties that trouble your correspondent K——, in regard to evolutionary ethics, will, I think, disappear by enlarging his conception of happiness so as to include the happiness of society as well as that of the individual. In the long run, and in the main, these two coincide; but it is evident that with our present imperfect moral development there must arise many instances where the welfare of society runs counter to the happiness of the

individual. All this is involved in what Mr. Spencer teaches in his Data of Ethics; but perhaps it may be made plainer if we substitute for happiness the more comprehensive word adaptation. Perfect adaptation —that is, the complete and continuous adjustment of internal relations to external relations — would be complete happiness were it attainable, as it covers both the physical and psychical sides of our nature. It includes perfect bodily health as well as perfect mental and moral health, and does not oblige those who teach scientific ethics to face the "disagreeable conclusion" mentioned by your correspondent. In fact, the substitution of adaptation for happiness as the criterion of morals has several advantages.

It bases morality upon the principles of evolution. The development of society implies the development of certain moral instincts in the individuals who compose it; for it is apparent that, unless selfishness is more or less restrained by altruism, social growth would be retarded if not stopped. It explains why opinion varies both in time and place in regard to conduct, for actions are considered virtuous by a given society when they are regarded as conducive to its welfare and sinful when they are supposed to be injurious. It accounts for the gains which altruistic sentiments have made upon egoistic, in man's progress upward, as social contact creates and fosters a public opinion in favor of the former, which is slowly becoming more and more irresistible, until finally shall dawn the era of peace upon earth and good-will to men.

ROBERT MATHEWS.

ROCHESTER, N. Y., *January* 4, 1891.

EDITOR'S TABLE.

A PROFESSION FOR WOMEN.

THE crusade for the higher education of women that is now going on seems to have two chief impelling forces. One is the necessity for a growing number of the sex to provide for their own support; the second is the weariness of being idle that is afflicting another class of women. It is not necessary to point out here the reasons why women without male supporters are more numerous than formerly. They are mainly such as cause the deferment or abandonment of marriage by many men and women, through making family life less attractive and single life more satisfactory to both sexes. The same reasons, with others, operate to increase the number of wealthy women who have nothing to occupy them.

As a remedy for both these ills, collegiate education is being widely prescribed. This promises admission to lucrative professions to the bright women who must support themselves, and offers the degree of a men's college as the goal of their wealthy sisters' efforts. These remarks have been suggested by a recent volume in the International Education Series, on Higher Education of Women in Europe, by Helene Lange, which advocates the collegiate education idea, though in a notably reasonable and discriminating manner. But this way of treating the difficulty has serious defects. In the first place, it tends to increase the evil which it is expected to cure. The lack or deferment of suitable marriage is what is at the bottom of the whole matter, and the literary and professional education of women would make this lack greater. Independence of a husband's support would favor maiden life (though to the extent of preventing false marriage this is a good thing); so, too, would the absorption of women's interest and ambition in study or in a professional career. Moreover, women who have been occupied with books or business to the exclusion of learning how to make a home will not be very desirable as wives. Secondly, the proposed remedy would stimulate that undesirable trait, selfishness. It puts before a young woman the ideal of learning a profession for the benefit of *self*, of winning honors for *self*, of acquiring a high culture for *self*. It crowds out the opposite idea of fitting herself to co-operate with a husband for their joint benefit and that of their children, or the idea of using

her leisure for the elevation of the race. Furthermore, anything that teaches men and women to live independently of each other lessens the respect that belongs to the family as an institution, and robs parenthood of the honor that it deserves.

Before reading thus far, our critics will be demanding what alternative remedy we have to offer for the ills whose existence we admitted at the outset. We would strike at the root of the difficulty, and remove the disturbing cause instead of accepting it as inevitable. Earlier and more numerous marriages should be the rule, and women can bring this about if they choose. Mothers should so rear their daughters that young men can afford to marry them. A young woman properly brought up would be healthy and strong enough to need few or no servants and little doctoring; she would be competent to manage a household; and would not have a fondness for extravagance that is like a second nature. Women should discountenance the men who remain bachelors without good reason, and especially should shut out of good society those dissipated youths and wealthy rakes who are the deadliest enemies of the marriage relation. By these and similar means women can secure for most of their sex the most natural mode of support—that which belongs to a wife. For those women who do not lack means, but only an object on which to employ their energies, there is worthier occupation than acquiring culture for its own or rather their own sake. There are social and ethical questions, and other problems, whose solutions are demanded, and which can be best solved by women. There are affairs to be administered and abuses to be corrected for which woman's nature especially fits her; and there are other fields of labor, not hers exclusively, but which are imperfectly worked because left to man alone. As a shining example of women who have already seized upon such a chance for usefulness may be mentioned the Ladies' Health Protective Association in New York city, which is engaged in abating nuisances prejudicial to the public health. There might remain some women who could not be provided for in the ways just suggested, but they would be exceptions, and their wants could properly be met by exceptional methods.

There is a class of women to whom the counsel in this article will be very distasteful. The career of a wife and mother has little appreciation in their eyes. It is not enough appreciated by a large share of both sexes. But the remedy for this is in the women's own hands. If they would have an honorable profession, they have only to do a quality of work that is worthy of honor. Surgery was once a branch of the barber's trade, and certainly no more honored than house-work is to-day; but men have made a study of it, have given it a broad, scientific basis, invented instruments and processes to increase its efficiency, and arranged a systematic mode of learning its practice, with the result that the surgeon of to-day has one of the most honorable of professions. In a similar way dressmaking—which is a trade in the hands of women—has been made a profession in the hands of one man. The ordinary dressmaker gets little respect; Mr. Worth is held in high esteem, and the difference is that he does work which compels esteem. The ordinary housewife and mother takes little pains to learn her business; she follows rule-of-thumb methods handed down from her great-grandmother, introducing no improved processes or appliances, and feeling no shame if her home is ill managed or her children ill trained. If women doubt that competent administration in the home would win the same esteem that is paid to the competent surgeon, or lawyer, or merchant, or college professor, they should recall the Roman matron, Cornelia, whose fame has already lasted for nearly a

score of centuries. With her spirit the modern woman should say of her home, "This is my diploma"; and of her children, "These are my degrees."

SCIENCE AND CIVILIZATION.

THAT civilizations have perished in the past is a commonplace of historical reflection. That all is not well in the latest of civilizations is a truth which earnest men are feeling more deeply from day to day. Undoubtedly there are influences at work that tend to antagonize the true evolution of society. There probably never was a time when so many people felt themselves unsuited to their environment, when there was so much of unsatisfied ambition or so much unsettlement of purpose. We have disengaged forces that sometimes threaten to be too strong for us. We have created in thousands of minds expectations which even the improved conditions of modern life are unable to satisfy. Men have been taught that two giants of unexampled strength are ready to do their bidding, one called *Science* and the other *Legislation:* with these the world is to be renovated. That there can be little renovation apart from renovation of individual character is a truth which, whether believed in or not, has been kept in the background. The discussion that has taken place regarding "General" Booth's scheme for the extinction of pauperism and degradation in London has made it clear that certain guiding principles of social reformation are seriously needed, and that, unless these are found and acted upon, our whole social system may suffer grievous injury.

The key-note, the watch-word of social reform, some say, is to be found in *charity*—that is to say, in the benevolent interest of man in his fellow-man. These would organize moral salvage corps, would visit the poor and degraded and try to heal and restore them by kind words, good advice, and pecuniary or other equivalent assistance. That, under favorable circumstances, something can be accomplished in this way we should be extremely sorry to deny. Many a man doubtless needs no more than some slight, kindly intervention to enable him to recover a wavering balance and betake himself with fresh courage to the battle of life; but whether wide-spread social diseases are to be successfully coped with by charity in any of its forms is still a question. Charity is the word of Religion, and a beautiful word it is, expressing fundamentally a beautiful idea; but it is not the word of Science: the word of Science is Justice. Are, then, charity and justice incompatible? Far from it; there is a charity that is just—that is no more and no less than justice—and there is a justice that is charitable in the highest sense. We shall attack our social problems successfully only when, leaving all sentiment and all unproved assumptions aside, we seriously ask ourselves as a community what we ought to do, what justice requires us to do. If justice demands what might be called charity, let us not call it charity or disguise it under any other specious name, but let us call it justice and nothing else. If it is pleasant to get good in the form and name of charity, far sweeter and far more strengthening and every way beneficial is it to get it in the form and name of justice. It is a misfortune that the word justice has been so often associated with the penal administration of the law, and that in this way it wears a severer aspect than properly belongs to it. The law should be a terror to evil-doers and to none else; and we should accustom ourselves to think of justice as the most beneficent of divinities and the very palladium of our civilization. This it is, whether we so recognize it or not; only as we are in the main a nation of just men is our civilization secure.

To follow out in detail the applications of the principle of justice to our

social miseries and weaknesses is beyond our present purpose. So much, indeed, do people in general think of charity as a social remedy, and so little do they think of justice in that light, that it would not be surprising, were a change of policy from charity to justice decided on, if there should be a marked unreadiness and inaptitude for the practice of the new virtue. It might be found, moreover, to involve a great deal more than charity had ever appeared to involve. When a man is bestowing charity he may give little or much; as it is all a free gift, there is virtue, there is merit, there is room for self-commendation, however little he gives; but when he is dealing out justice the case is different: he must go to a certain line or *he fails in justice* and is open to condemnation. No wonder charity is the favorite virtue; but the more we compare the two the more we see that justice is the better for the soul. It does not flatter self-love, and it is more favorable to respect for our fellows.

Justice, we have said, is the word of science, and herein we see where science may powerfully help to strengthen the social fabric. On the one hand, science tends to produce social ferment by continually introducing new ideas and continually unsettling commercial arrangements in the various ways which Mr. D. A. Wells has so well pointed out. On the other hand, if science can be made to ever inculcate and reinculcate the idea of justice, it will do vastly more by that means to knit, than it possibly can in any other way to loosen, the bonds of society. Let us have science, then, in our schools; but let it not be a mere matter of experimenting with gases and acids, with air-pumps and electric machines, but let it be brought home as Nature's message to the hearts as well as to the minds of the young. Let it teach them justice; let it impress upon them that there is a right, that there is a true, that there are moral balances as well as chemical ones, that there are conditions of moral stability and instability just as of chemical or mechanical or electrical. The teacher who can not extract moral instruction and inspiration out of physical science ought to leave it alone—whether he is fit to teach anything is a question. There are countless useful analogies to be drawn between the laws of matter and those of mind and of society. To mention but one that occurs to us at this moment, the law of the expansion of gases with diminishing pressure is an apt illustration of the expansion of human desires with enlarging scope, or, in other words, as external pressure diminishes. As in the one case with every added volume the elasticity becomes less, so too often in human life, the more desires are gratified, the less there is of that elasticity of spirits which made life seem worth living.

The law of natural selection, again, might be made to teach many most useful lessons. It shows in the first place that, as the world is constituted, it is a great privilege to live. Then, if life is to be maintained on a satisfactory footing, it must be by the exercise of prudence, of industry, and whatever other virtues make for individual success. The thought that so many lives are abortive, far from cultivating pride or selfishness, should add a certain tinge of solemnity to all one's thoughts of life. "In me," each of us may think, "that spark which struggled vainly to maintain itself in so many others has become a living flame. How shall I use the powers so mysteriously bestowed and on which in many ways such vast issues depend? Shall I make life, as I ought, a sacred thing, or shall I pass my days in idle frivolity or yet more idle gloom? Seeing that I possess the gift of life, shall I not strive to raise it to its highest value and its best expression?" If life is a struggle, it is a struggle not so much against living competitors—that is a view of which quite too much is made—as against antagonist

influences chiefly in the way of ill-regulated desires; and the law of natural selection rightly expounded will teach us that, if we wish to survive, we must cultivate all the qualities that make for fitness, and repress those that tend to produce unfitness.

LITERARY NOTICES.

THE EARTH AND ITS INHABITANTS. By ÉLISÉE RECLUS. North America, Vol. I. New York: D. Appleton & Co. Pp. 496. Price, sheep, $6; half morocco, $7.

THE American edition of this great descriptive work, by the eminent French geographer Reclus, has now reached the section devoted to North America. This division will probably require four volumes, the first of which is now before us. A chapter sketching the early discoveries in the New World and the chief features of the Western Continent introduces the volume. This is followed by detailed descriptions of the northern parts of the continent, comprising Greenland, the neighboring islands, Alaska, and the British possessions, including Canada. The physical features, flora, fauna, and inhabitants of each region are fully described. In the account of Greenland the glaciers of that ice-bound land are a prominent feature. Their distribution, extent, rates of movement, and mode of termination are described, and their appearance and arrangement are represented by many pictures and maps. The nature of the illustrations in this work is already known to our readers from the article on Greenland and the Greenlanders, in the Monthly for last July, for which some of them were borrowed. The geography of Alaska is given with much detail so far as it is known, and the progress of exploration in that Territory is sketched. Here, again, the glaciers demand considerable attention. Maps show the zones of temperature and trees, and the distribution of the native tribes and the animals is also pointed out. About three hundred and fifty pages are devoted to Canada and the other British provinces in North America. The reader is led from the rivers and fiords of British Columbia, through the wild Northwest Territory, among the posts of the Hudson Bay Company, and the lakes of the Winnipeg region, then down the St. Lawrence through Ontario and Quebec, to the Maritime Provinces, finally reaching Labrador and Newfoundland. The description deals with—besides the natural features—the social and political conditions, trade, languages, religions, etc., of the several divisions of the country. The full-page pictures, which are liberally scattered through these chapters, represent wild scenery of the central and western regions, the features and dress of the natives, and the large towns on the eastern rivers and seaports. The maps, which are very numerous, are from actual surveys, and hence contribute to the scientific accuracy which is characteristic of the whole work. Statistics of area, population, trade, etc., are given in appendixes.

THE METEORIC HYPOTHESIS: A STATEMENT OF THE RESULTS OF A SPECTROSCOPIC INQUIRY INTO THE ORIGIN OF COSMICAL SYSTEMS. By J. NORMAN LOCKYER. London and New York: Macmillan & Co. Pp. 560. Price, $5.25.

THE purpose of this volume is to bring together and co-ordinate the observations which have been made up to the present time on the spectra of the various orders of cosmical bodies in connection with laboratory work on which the author has been engaged since 1868. It embodies in a connected form, among other matters, various reports made by him through the Solar Physics Committee to the Royal Society. It is, in fact, a natural sequel to the Chemistry of the Sun, published in 1887, in which were presented researches suggesting that many solar phenomena might owe their origin to falls of meteoric masses on the sun's surface. The theory here presented is substantially an enlargement and extension to the universe of the hypotheses therein set forth. Beginning with a chapter of history and facts on the fall and nature of meteorites, the author treats in successive chapters of the Spectroscopy of Meteorites; Meteorites in the Air, in the Solar System, and in Space; Proposed New Grouping of Cosmical Bodies; the Origin of Binary and Multiple Systems; and the Variability in Light and Color of Cosmical Bodies. Among his principal General Conclusions are: that all self-luminous bodies in the celestial space are composed either of swarms of meteorites

or of masses of meteoric vapor produced by heat. The heat is brought about by the condensation of meteor-swarms due to gravity, the vapor being finally condensed into a solid globe. That the existing distinction between stars, comets, and nebulæ rests on no physical basis; that stars, the temperatures of which are increasing, do not resemble the sun, but consist chiefly of discrete meteoric particles, just as comets do on Schiaparelli's hypothesis; and that the spectra of all cosmical bodies depend upon either the heat of the meteorites produced by collisions, and the average space between the meteorites in the swarm, or, in the case of swarms wholly volatilized, upon the loss by radiation since complete vaporization.

THE TSHI-SPEAKING PEOPLES OF THE GOLD COAST OF WEST AFRICA. Pp. 343.—THE EWE-SPEAKING PEOPLES OF THE SLAVE COAST OF WEST AFRICA. Pp. 331. By A. B. ELLIS. London: Chapman & Hall.

THE purpose of the author in these books, which constitute part of a series, is to show by examples taken from the negro peoples the subjects of them, how the evolution of religion may proceed. Four peoples have been had in view: the Tshi-speaking peoples of the Gold Coast; the Ga-speaking peoples of the Gold Coast; the Ewe-speaking peoples of the Slave Coast; and the Yoruba-speaking peoples of the Slave Coast. Their languages all belong to one family, indicating, apparently, that they have all sprung from a common stock. They occupy territories on the west coast of Africa contiguous in the order in which they are named, from west to east, and exhibit, on the whole, a gradual advance in civilization, in the same order. The author suggests that the differences in civilization may be due to differences in local conditions and surroundings and in the character of the country, which opens up from the forest regions of the west, where density of population is discouraged and communication is difficult, to the open plains of the Yoruba country. The religious beliefs of the Ga-speaking people resemble those of the Tshis, and are not considered for the present. Those of the Yorubas are reserved for a future volume. The best-known representatives of the Tshi-speaking tribes are perhaps the Fantis and Ashantis. Throughout the vast tract of forest inhabited by them, they live in insignificant villages and hamlets, built in small clearings in the forest, between which communication is kept up by narrow forest paths. Ideas permeate among them but slowly; and notwithstanding an intercourse on the part of the inhabitants of the sea-coast with Europeans, which has existed for more than four hundred years, they are much in the same social and moral condition as they were at the time of the Portuguese discoveries. The Ewe-speaking peoples, among whom are the Dahomis, present the ordinary characteristics of the uncivilized negro. In early life they evince a degree of intelligence which, compared with that of the European child, appears precocious, and they acquire knowledge with facility till they arrive at the age of puberty, when the physical nature masters the intellect, and frequently deadens it. Like most inhabitants of the tropics, they have more spontaneity and less application, more intuition and less reasoning power, than the inhabitants of temperate climes. These traits, of both peoples, are ascribed partly to the climate, partly to physical peculiarities, and partly to the social condition and the general sense of insecurity. As a result of all the inimical influences, the energy of all has degenerated into idleness and sensual enjoyment, "and it will take centuries to raise them." Incidentally, in collecting information concerning the religion of these peoples, the author also gathered facts concerning other matters—their laws, government, various customs, proverbs, folk-lore, etc.—and these subjects are also presented, not as in a full record, but to fix a starting-point from which a systematic and more complete study may be made.

GEOLOGICAL SURVEY OF NEW JERSEY. FINAL REPORT OF THE STATE GEOLOGIST. Vol. II, Part II. Zoölogy. Trenton. Pp. 824.

THE present "part" of the final report of the late Prof. Cook contains two papers: A Catalogue of Insects found in New Jersey, by John B. Smith; and a Descriptive Catalogue of Vertebrates, by Julius Nelson. Mr. Smith confesses to having had to encounter many difficulties in preparing his catalogue

of insects. The contrasts in the geological features of the State influence the botany, and this affects the character of the insect forms. There are no large collections of insects in the State. Collectors are few. Some aid was got from collectors in New York and Philadelphia, but their excursions into New Jersey covered only a limited area, and were mainly directed in special lines. Except in Coleoptera and Lepidoptera, New Jersey is practically unexplored, and the northern and northwestern regions are not represented, even in the collected orders. The author himself, collecting in all orders, in different parts of the State, though for too short a time, has been able to add considerably to all the lists, from his own experience. His catalogue includes 6,098 species, of 2,307 genera and 238 families, and is arranged after the Linnæan system. Mr. Nelson's catalogue of vertebrates is a revision of Dr. Abbott's catalogue of 1868, and it has been found a laborious task merely to incorporate the changes in nomenclature and classification which have been made within the last twenty years. Mr. Nelson has added descriptions of each species, with particular reference to features distinguishing it from its allies; and the descriptions have been made most complete for birds and fishes.

PRINCIPLES OF GENERAL ORGANIC CHEMISTRY. By Prof. E. HJELT, Helsingfors. Translated by J. B. TINGLE, Ph. D. London and New York: Longmans, Green & Co. Pp. 220.

EVERY one who has had anything to do with the teaching of organic chemistry will assent to the statement of Prof. Hjelt that students are very apt to overlook general principles and relations in their endeavor to remember particulars concerning single substances. To remedy this defect he has made a book, intended as a supplement to ordinary text-books, which is devoted to the chemical philosophy of the carbon compounds. Its object is to extend and systematize the knowledge of these substances which the student has obtained from other sources. In Part I the composition, constitution, and classification of organic compounds are discussed and explained. Part II is devoted to illustrating the connection between the constitution of organic compounds and their chief physical properties. Part III deals with the chemical behavior of organic compounds. The reactions described in this section are arranged according to the results—dehydration processes, for instance, being all classed together. Two editions of the work having been received favorably in Swedish, a German version was prepared by the author, and from the latter the English translation has been made.

THE COAST INDIANS OF SOUTHERN ALASKA AND NORTHERN BRITISH COLUMBIA. By Ensign ALBERT P. NIBLACK, U. S. N. Washington: Smithsonian Institution. Pp. 161.

THERE is much to tell about the Alaskan "wards of the nation" and their relatives in the British dominions. Sufficient evidence is given in this monograph to show that the Indians of the Northwest coast have a high degree of skill in many arts, industries, and pursuits, a systematic tribal organization, interesting customs and ceremonies, and traditions and folk-lore which are instructive to the student. The information here presented is based on the collections of objects in the United States National Museum, and on the personal observation of the author in connection with the survey of Alaska. Subdivisions of the above topics are treated with varying fullness in fifteen chapters, the text being illustrated with seventy full-page plates. The carvings in wood and slate, and the woven garments and baskets here figured, display much ingenuity, while the accounts of the way in which these peoples have adapted themselves to the ways of civilization give proof of much mental strength.

INORGANIC CHEMISTRY, THEORETICAL AND PRACTICAL. By WILLIAM JAGO, F. C. S. London and New York: Longmans, Green & Co. Pp. 458.

THE author of this work is an experienced writer of chemical text-books. The present volume is described as a manual for students in advanced classes—that is, for those who have some acquaintance with the common elements, and some knowledge of chemical reactions. It does not omit any essential subject, but elementary matters are treated briefly, while larger space is given to the laws of chemistry and to manufacturing processes. A feature of the book is a

brief statement of the industrial applications of all substances that have important uses. The volume is well printed, and contains seventy-eight illustrations and a colored plate of spectra.

A very attractive and well-made text-book for beginners is the *Elementary Geology*, by *Charles Bird*, which is one of Longmans' Elementary Science Manuals (Longmans, 80 cents). It is written in a simple and easy style, giving a vivid idea of how geological changes have taken place, and with examples, mostly English, of the formations described. The economic use of each rock mentioned is also generally stated, and there are 247 helpful illustrations, and a colored geological map of the British Isles. The sort of teaching that the author gives is well indicated in his preface. He reports the successful use of the lessons in this book before they were printed, saying that they sent many town boys on long walks into the country, and enabled practically the whole class to pass the South Kensington elementary examination. But he deems the abiding interest aroused in natural phenomena and outdoor objects "a more valuable and useful possession than even a South Kensington certificate."

A *Text-Book of Practical Plane and Solid Geometry*, by *I. H. Morris*, has been added to the same series (Longmans, 80 cents). It is devoted to the construction of geometrical figures or geometrical drawing, and contains several hundred problems, which range from the simplest to those of considerable complexity. The part of the volume dealing with plane geometry leads up to the drawing of spirals of different kinds and other curves. This is followed by a chapter on the application of geometry to the construction of patterns and simple tracery, including geometrical tracery windows. The drawing of plans, elevations, and sections of solids, such as prisms, pyramids, and cones, in simple positions is then taken up. The second section of the book deals with the projection of points and lines, and the representation of planes by their traces on co-ordinate planes, and also the projections of solid objects of simple form. Lists of exercises consisting of problems taken from the examination papers of various English colleges are introduced at intervals. The diagrams appear in all cases on the page opposite the problems.

The *Geography of Europe*, by *James Sime*, corresponds in character with the preceding volumes of Macmillan's Geographical Series, to which it belongs (Macmillan, 80 cents). The chief feature of the book is the attention it gives to the past evolution of political divisions. The historic associations of towns have also been made prominent. The author states, as to the information he has aimed to include in the volume: "In the case of each country the physical features are first described; then an attempt is made to mark the stages of its history, so far as they are related to geography. Next I have brought together some of the leading facts relating to government, population, and national character, religion and education, and industry and trade. Finally, an account is given of the principal towns, these being generally grouped under the historic divisions to which they respectively belong." As there is a volume devoted to the British Isles in this series, only a short chapter on the United Kingdom is included in the present work. There are thirty-three cuts representing characteristic buildings and places.

In the same series has just appeared a volume on *India, Burmah, and Ceylon*, by *Henry F. Blanford* (price, 70 cents). The subject-matter of this book may be described as wholly geographical, and the author says that, in order to bring so large a subject within less than two hundred pages, it has been necessary to restrict the description to the most important features. But few historical allusions are to be met with in these pages. The text is illustrated with twenty-seven cuts. Neither this nor the preceding book contains maps, as both are designed to be used with an atlas.

From the Smithsonian Institution we have received a number of monographs, in pamphlet form, which are to constitute parts of volumes soon to be issued. *The Report on the National Museum for 1888*, by *G. Brown Goode*, assistant secretary in charge, contains some facts in regard to the history and organization of the museum, a review of the work of the year, a list of the more important accessions, and other information. During the year a Department of Living

Animals was organized, which the secretary hopes will develop into a national zoölogical garden. Among these pamphlets is a paper by *Walter Hough*, on *Fire-making Apparatus in the United States National Museum*. It contains descriptions of a large number of ways of making fire, with sixty cuts of apparatus. The methods are classified and arranged in their presumed order of development as follows: Fire-making by twirling one stick on another, by sawing and by plowing one stick with another, by striking flint and pyrites together, and flint and steel. Most of these methods have been used by the Indians or Eskimos of America. *A Study of Prehistoric Anthropology*, designed as a hand-book for students beginning this science, has been prepared by *Thomas Wilson*, curator of this department in the National Museum. It is a general view of the subject, with a bibliography and many cuts representing implements of stone, bone, bronze, etc., dolmens, vessels, ornaments, and human representations. *Frederic A. Lucas* has prepared an account of *The Expedition to the Funk Island*, which he made in 1887, to procure bones of the great auk. The bones obtained equaled in number all other collections combined, and a thorough exploration was made of the island. The paper is illustrated with a picture of the bird and one of its egg, a sketch map of Funk Island, and diagrams. A popular account of this expedition was contributed by Mr. Lucas to the Monthly for August, 1888. *A Catalogue of the Hippisley Collection of Chinese Porcelains, with a Sketch of the History of Ceramic Art in China*, prepared by *Alfred E. Hippisley*, is now published. In 1887 this large collection was deposited in the National Museum, with the understanding that it should be allowed to remain on exhibition for at least two years, and that the museum should print a descriptive catalogue. The catalogue occupies some fifty pages, containing 438 numbers, and the history of ceramic art is quite extended.

Several Bulletins of the Geological Survey have reached us together. No. 58 contains a paper on *The Glacial Boundary* in the Central States, by Prof. *G. F. Wright*, with an introduction by *T. C. Chamberlin*. It is occupied mostly with observations on the distribution of the till, but contains also some facts in relation to striated surfaces of rocks in place. The paper contains also the evidence for and against the hypothesis of a glacial dam at Cincinnati. Recent finds of palæoliths pointing to the probable existence of interglacial man in Ohio are here reported; the relation of the loess to the glacial drift, and the finding of gold near the glacial margin, are also touched upon. Eight plates and ten figures illustrate this monograph. No. 59 is by *Frederick D. Chester*, on *The Gabbros and Associated Rocks in Delaware*, the massive gabbro being the most prominent formation in the northern part of that State. The paper is illustrated by a map and five figures. A *Report of Work done in the Division of Chemistry and Physics* for the year 1887–'88, by *F. W. Clarke*, forms No. 60. It contains an extended account of the occurrence and utilization of natural soda, by Thomas M. Chatard, analyses of various rocks, ores, waters, and meteorites, and notes on a number of other subjects. No. 64 is a similar report for 1888–'89, and is occupied largely with examinations of minerals. No. 61 is *Contributions to the Mineralogy of the Pacific Coast*, by *William H. Melville* and *Waldemar Lindgren*, the objects of study being cinnabar crystals and other specimens collected during a recent examination of the quicksilver deposits of California. *A Bibliography of Palæozoic Crustacea*, by *Anthony W. Vogdes*, forms No. 63. It comprises a list of authors, a catalogue of trilobites, and a catalogue of non-trilobites. No. 66 is *On a Group of Voleanic Rocks from the Tewan Mountains, New Mexico, and on the Occurrence of Primary Quartz in Certain Basalts*, by *Joseph P. Iddings*. We have also received a paper by *Charles A. White*, entitled *On the Geology and Physiography of a Portion of Northwestern Colorado and Adjacent Parts of Utah and Wyoming*, which is to form a part of the report of the Geological Survey for 1887–'88. The district here described lies round about the Uintah Mountains, and the phenomena specially considered relate to its geological structure and to surface drainage. A colored geological map of the region and a number of diagrams are given.

The object of the series of reports on the *Mineral Resources of the United States*,

of which Mr. *David T. Day*, Chief of Division of Mining Statistics and Technology, is the editor, is to record annually the most important facts concerning the development of the minerals found in the country. The present, the sixth volume, is for the year 1888. The method of treatment pursued in the previous volumes is continued in this. The report opens with a summary statement as to the condition of each mineral industry at the close of the period under review—the calendar year. At the end of this summary is a table in which the values of the various products are added, so as to furnish an estimate of the relative importance of the mining industry as a whole. Following the summary each important mineral industry is discussed in a separate chapter. The statistical tables given in former reports are extended to include 1888, but otherwise the material in each chapter is intended to show the developments in 1888 only and not in previous years. To facilitate the consultation of all the volumes of the series, an index to the six is in preparation. (Government Printing-Office, Washington.)

Volume XXIV of the Annals of the Harvard Observatory is devoted to *Results of Observations with the Meridian Photometer*, from 1882 to 1888, by *Edward C. Pickering* and *Oliver C. Wendell*. The measurements are of stars having magnitudes brighter than 9·1 of the Durchmusterung. The objects observed number 20,982. Four photometric settings were made upon each object, and these were repeated on the average between three and four times. The total number of settings is 267,092.

The *Elements of the Differential and Integral Calculus* of Prof. *Arthur Sherburne Hardy* (Ginn & Co.) is based on the system of rates which, in the author's experience, has proved most satisfactory in a first presentation of the object and scope of the science. The object of the Differential Calculus is the measurement and comparison of rates of change when the change is not uniform. The rate at any instant is determined by ascertaining what the change of a quantity would have been in a unit of time had its rate remained what it was at the instant in question. This change the Calculus enables us to determine, however complicated the law of variation may be.

The Bureau of Education has issued, among its Circulars of Information for 1890, a book of some four hundred pages on *The Teaching and History of Mathematics in the United States*, by Prof. *Florian Cajori*. The first chapter, dealing with elementary schools, the colleges then existing, and self-taught mathematicians in colonial times, describes persons and ways of teaching, many of which seem very quaint to modern eyes. The next two periods treated cover respectively the influx of English mathematics and the influx of French mathematics. The list of colleges grows longer in these two chapters, and among the other topics which now enter into the history are the surveying of Government lands, mathematical journals, and the United States Coast and Geodetic Survey. A chapter on mathematical teaching at the present time contains the answers obtained by sending a list of questions to several hundred colleges, normal schools, academies, etc. This is followed by several historical essays on mathematical subjects, and a bibliography of fluxions and the calculus.

The Laboratory Manual of Chemistry, Medical and Pharmaceutical, by *Oldberg and Long*, which we noticed in July, 1888, has come out in a revised and enlarged edition (Keener, $3.50). The preface states that the greater part of this edition is an exact reprint of the first, but that the chapter on the chemical analysis of urine has been entirely rewritten, and a new chapter has been added on the microscopic examination of the sediment.

Mr. *Westel W. Willoughby*, in his monograph on the *Supreme Court of the United States* (Baltimore, Johns Hopkins Press), holds up that tribunal as an illustration of the maxim that in America, as elsewhere, institutions are the result of an evolution, and not an invention; and that constitutions, whether written or unwritten, are but the results of the gradual recognition of those laws and methods which are the best suited for the government of a politically organized people. The history of the Supreme Court begins with accounts of the judiciaries in the colonies and under the Confederation, and is carried on through the Convention, the State Conventions, the establishment and jurisdiction of the Fed-

eral Courts; with reviews of the relations of the Supreme Court with Congress, the State Legislatures and Judiciaries, and the Executive; the Supreme Court and politics; the present condition and needs of the Supreme Court; and the conclusion, resulting in the assertion that it should be a matter of special congratulation that "of all our great institutions the Supreme Court is most distinctly the product of American genius, and that its success is a direct testimony to the high political ability of our American people."

Bulletin No. 6 of the Eleventh Census is a preliminary statement of the *Financial Condition of Counties*. It has been prepared by Special Agent *T. C. Copeland*, and shows the bonded, floating, gross, and net debt, sinking fund, available resources, and annual interest charge of each county in the United States. The Bulletin contains also a series of maps illustrating the geographical distribution of county debt and resources. Bulletin No. 19 gives partial results of an inquiry into the *Vital Statistics of the Jews in the United States*, conducted by Dr. *John S. Billings*. A discussion of the tables by Dr. Billings brings out the apparent fact that the birth-rate is decreasing and the death-rate increasing among the Jews with prolonged residence in this country.

Economic subjects are being written upon to-day by thoughtful men in every calling. A recent addition to the volume of literature thus produced is *The Distribution of Wealth*, by *Rufus Cope* (Lippincott, $2). It embodies the author's opinions on the production of wealth, its division between labor and capital, savings, interest, taxation, protection and free trade, monopolies, and allied topics, closing with a chapter on education of the people, secular and religious. It also contains full and free comments on certain recent books and magazine articles, and in some cases the writers are criticised as well as their published views. On the question at present most prominent —the tariff—the author takes the position of an apologist for protection. Throughout the volume his statistics are for the most part those of the census of 1880, although his table of tariff revenues is only three years old. From education, he hopes that the working classes will gain much in the way of bettering their condition.

A quarterly magazine called *The Monist* has been established, with the stated object of continuing a portion of the work hitherto done by The Open Court (The Open Court Publishing Company, $2 a year), or of developing "a unitary conception of the world, free from contradictions and based upon the facts of life." A result which is expected to flow from the accomplishment of this task is a purification of our religious ideals. The opening article of the first number is a reply by G. J. Romanes to certain statements of A. R. Wallace on Physiological Selection. The line of this reply is that Mr. Wallace has professed hostility to the views of Mr. Romanes and Mr. Gulick, and afterward reproduced them as original. Prof. Cope contributes an analysis of The Material Relations of Sex in Human Society, from which he draws the conclusion that, while woman is under some social disadvantages in respect to man, these are based on facts of nature which can not be changed, and that she has a full equivalent in advantages which are also derived from the natural order of things. Other articles in the number are The Immortality of Infusoria, by Alfred Binet; The Analysis of the Sensations—Anti-metaphysical, by Prof. Ernst Mach; The Origin of Mind, by Dr. Paul Carus; The Magic Mirror, by Max Dessoir; and Höffding on the Relation of the Mind to the Body, by W. M. Salter. There is also an installment of Literary Correspondence from France, by Lucien Arreat, a department of book reviews, a conspectus of the instruction in philosophy given at leading American colleges, and a list of psychological and philosophical articles in other periodicals.

Inquirendo Island, by *Hudor Genone* (Twentieth Century Publishing Company, $1), is a satirical story dealing with theological matters. Extracts from reviews on the slip sent out by the publishers show the religious press to be divided as to whether the book is religious or irreligious.

The Standard Dictionary of the English Language, to be published by Funk & Wagnalls, is intended to be such a dictionary as the people will find most useful for daily consultation. While the wants of scholars will not be overlooked in its preparation,

those of lay readers will be preferred. For this reason some departures will be introduced in it from the usual custom of dictionaries. Besides the spelling and pronunciation of the word, the first thing sought by the average man is its most common present meaning. For that reason, the meaning now most generally accepted is given first, while the less usual meanings and the obsolescent and obsolete meanings are remanded to back places. The etymologies are given after the definitions. The quotations by which the meanings are illustrated will be verified by reference to the particular work, chapter, and page of the author cited, in which the word is found. A large proportion of the verifying quotations are from the standard writers of the day; and, as between a foreign and an American author of equal authority, the American will be preferred. Pronunciations will be indicated in the alphabet suggested by the American Philological Association. The various departments of the work are to be prepared under the direction of scholars eminent in their respective specialties. The dictionary will be published in a single volume of more than twenty-one hundred pages, a little larger than the pages of the unabridged dictionaries, will be illustrated, will contain the usual supplements, and will be sold for $10 a copy, with a special discount to advance subscribers.

PUBLICATIONS RECEIVED.

American Academy of Medicine. Bulletin on the Value of Academical Degrees. Pp. 8.

Bellamy, B. W., and Goodwin, M. W. Open Sesame. (School Reader.) Ginn & Co. Pp. 361.

Burney, S. G. Studies in Psychology. Nashville, Tenn.: Cumberland Presbyterian Publishing House. Pp. 535.

Calendars for 1891. Styles & Cash, printers, New York—E. B. Treat & Co. Don't forget it Calendar.

Charity Organization Society, New York. Directory of Charities. Pp. 400.

Children's Aid Society, New York. Tenth Annual Report. Pp. 80.

Coy, Edward C. Greek for Beginners. American Book Company. Pp. 152.

Cresson, Dr. C. M. Water-supply and Disease in Philadelphia. Pp. 24.

Census, United States, Bulletin. Vital Statistics of Jews. Pp. 24.

Fall, Delos, Albion, Mich. Action of Alcohol on the Human Body. Pp. 16.

Fontaine, W. M., and Knowlton, F. H. Triassic Plants from New Mexico. Smithsonian Institution. Pp. 6, with Plates.

Foulke, William Dudley. Civil-service Reform in its Later Aspects. Society for Political Education, New York. Pp. 13.

Genone, Hudor. Inquirendo Island. New York: Twentieth Century Publishing Co. Pp. 347. $1.

Geological Survey, United States. Bulletins: No. 58. Glacial Boundary, Pennsylvania to Illinois. By G. F. Wright. Pp. 44.—No. 59. Gabbros, etc., in Delaware. By F. D. Chester. Pp. 40.—Nos. 60 and 64. Reports of the Division of Chemistry and Physics, 1887-'88 and 1888-'89. By F. W. Clarke. Pp. 150 and 60.—No. 61. Mineralogy of the Pacific Coast. By W. H. Melville and W. Lindgren. Pp. 33, with Plates.—No. 63. Bibliography of Paleozoic Crustacea. By A. W. Vogdes. Pp. 177.—No. 66. Volcanic Rocks from Tewan Mountains, New Mexico, etc. By J. P. Iddings. Pp. 34.

Gilbert, G. K. Lake Bonneville. Pp. 438. Washington: United States Geological Survey.

Hale, E. M., M. D., Chicago. Are Valvular Diseases of the Heart curable? Pp. 4.

Hamilton, Gail. A Washington Bible Class. D. Appleton & Co. Pp. 303. $1.50.

Harding, George. Argument on Patent Suit. Self-carrier for Self-binding Harvesters. Philadelphia. Pp. 124.

Heilprin, Prof. Angelo. Corals, etc., of the Gulf of Mexico. Pp. 14, with Plates.

Iowa, University of, Engineering Society. The Transit. Vol. I. No. 2. Pp. 96, with Plates. 50 cents.

Ivera, J. E. Echinoderms from the Northern Coast of Yucatan, etc. Pp. 24, with Plate.

Lockyer, J. Norman. The Meteoric Hypothesis. Macmillan. Pp. 560. $5.25.

Maclean, J. P. Fingall's Cave. Cincinnati: Robert Clarke & Co. Pp. 49. 75 cents.

Madison, Andrew W., New York. The True Theory of Christianity. Pp. 86. 15 cents.

Nichols, Prof. E. L., Cornell University. The Artificial Light of the Future. Pp. 21.

Norton, C. L. Political Americanisms. Longmans. Pp. 134. $1.

Pennsylvania, University of. Museum of Archæology. Annual Report. Pp. 54.

Powell, J. W. United States Geological Survey. Ninth Annual Report. Pp. 717, with Maps and Plates.

Powers, Edward, Delavan, Wis. War and the Heathen. Pp. 202. $1.

Stone, George H. Glacial Sediments of Maine. Pp. 24.

Tolstoi, Count Leo. The Fruits of Culture. Boston: Benjamin R. Tucker. Pp. 185.

Tourgee, Albion W. Murvale Eastman, Christian Socialist. Fords, Howard and Hulbert. Pp. 545. $1.50.

Wheeler, George Montagu, U. S. A. A Universal World's Exhibit. Washington. Pp. 6, with Chart.

Whitman, C. O., Boston. Marine Biological Laboratory. Report. Pp. 27.

Williams, G. H. Elements of Crystallography. New York: Henry Holt & Co. Pp. 250.

Wilsing, J. Determination of the Mean Density of the Earth. Smithsonian Institution. Pp. 12.

POPULAR MISCELLANY.

White-fish in Lake Ontario.—A number of citizens of Rochester are endeavoring to interest the people of the State of New York in stocking Lake Ontario with white-fish. The lake once afforded abundance of this sweet and juicy fish, as Lake Erie does still, but they have now become scarce in it. The citizens to whom we refer

show that Ohio, Michigan, Illinois, Wisconsin, and the Dominion are busily stocking their lakes; while New York, with Ontario and numerous smaller lakes adapted to the raising of white-fish, is doing comparatively little in this particular direction. "We ought," they say, "to put out from thirty million to fifty million white-fish per annum." For this purpose we need regular and yearly liberal appropriations for stocking the lakes; stringent laws against netting or fishing during the spawning season or on spawning beds; laws forbidding the use of nets with a mesh smaller than is defined in them, and the catching and marketing of fish of less than a determined weight; the appointment of a first-class fish warden with enough deputies; and co-operation with the national and Dominion Governments.

The American Folk-lore Society.—The Council of the American Folk-lore Society reported at the recent meeting of that body that it stood upon a more solid basis than ever before, and its existence no longer needed to be justified. It may be confidently affirmed that no branch of American historical research offers a field for original investigation comparable to that presented by the traditions, rites, beliefs, and customs of the aboriginal races. On the other hand, the rapidity with which these tribes are penetrated by the ideas of civilization is strikingly illustrated by the movement now in progress among the Indian tribes of the United States. Every year, by increasing the difficulty of research, adds to the likelihood that many problems of primitive religion and usage will, in consequence of deficiency of information, remain permanently unsolved—a failure which, again, must of necessity obscure the comprehension of more advanced developments of human intelligence. It is therefore greatly to be desired that to the task of collection shall be devoted an energy in some degree commensurate with its importance, and that labors in this direction should be extended and systematized. As respects other branches of the work, especially observations concerning immigrant races, the material already printed in the publications of the society has been sufficient to demonstrate the various interest of the subject, the width of the field open to the collector, and the manner in which existing habits and beliefs serve to illustrate history. The Council has decided, if the society consents, to begin the publication of a Library of American Folk Lore, of which two volumes may be issued annually. While no member will be required to subscribe for these works, they will be obtainable for a subscription of two dollars in addition to the membership fee of three dollars, making the whole expense five dollars—for which all the regular publications of the society will be sent. The establishment of local chapters, which has already been successfully carried into effect in Philadelphia and Boston, is recommended. The society had four hundred and forty-seven members, with applicants enough to swell the number to more than five hundred. The Journal of American Folk Lore, the society's publication, is already, according to the statement of Prof. Crane, one of the editors, accepted as an authority in this country and in Europe.

The Bath in the Middle Ages.—An assertion made several years ago by Dr. Lyon Playfair, trusting to "worthless authorities," that "for a thousand years there was not a man or woman in Europe that ever took a bath," which was laughed at at the time, has been seriously refuted by the Rev. T. E. Bridget in his historical essay on Blunders and Forgeries. According to him, no one who has read much of the mediæval literature of any part of Christian Europe can doubt that the bath was constantly called into requisition. Among the accounts of Queen Isabella, wife of Edward II, is an entry of a payment "for repairs of the queen's bath and gathering of herbs for it." In a narrative of the arrival of Louis of Bruges, created Earl of Winchester in 1472, we find among other comforts provided for him that in the third chamber there "was ordered a *Bayne*, or ij, which were covered with tentes of white clothe." Mr. Dickson, the editor, tells us in the preface to the first volume of the Accounts of the Lord High Treasurer of Scotland, that "bathrooms were not uncommon in the houses of the great, and even the luxury of baths in bedrooms was not unknown. The accounts show two payments for broadcloth to cover a 'bath-fat'—that

is, to form a tent-like covering over it." The Abbé Thiers, in his Traité des Superstitions, mentions certain days on which silly people fancied it was wrong to bathe, a notion which would never have arisen had not bathing been a common practice.

The Battersea Home for Dogs.—The Battersea Temporary Home for lost and starving dogs took care last year of 24,123 dogs, for 3,613 of which homes were found—either new homes or by restoration to their owners. The report says that homeless dogs coming from the London streets were for the most part untrained, ill-bred, deformed, diseased, and half-starved, which, by the necessities of the situation, "found in the lethal chamber a merciful refuge." The muzzling order greatly augmented the number of dogs sent to the home during the latter part of the year, and threatened to overwhelm the resources of the institution. The home had prevented the spread of rabies by clearing the streets of the dogs most liable to be bitten by rabid animals, and had thus benefited the whole community. A cats' home had been added for the boarding of these animals, and neglected pussies were now found new homes or sent to the lethal chamber. The Duke of Portland—who presided at the annual meeting of the society—expressed his satisfaction at the personal interest which was shown by the Queen in the work of the home, as was proved by "her interposition to lengthen the time between the incoming of the dogs and the consequences of no one claiming them"—which is a beautifully delicate way of phrasing the unpleasant truth.

The Failure of the Apple Crop of 1890.—The failure of the apple crop of 1890 in western New York is accounted for by Prof. L. H. Bailey, of the Cornell Experiment Station, as a result of the weather, which was exceedingly wet and cool in the spring, then marked by unusually heavy rains, followed by drought. A blight was developed in the foliage of the trees, caused by the growth of the apple-scab fungus. The scab (*Fusicladium dendriticum*) is found upon the bracts or small leaves attending the flower-cluster, and is frequent upon very small fruits. It is nearly always present, to a greater or less extent, upon both leaves and fruit, but it is rarely so destructive to foliage as in the last year. It has increased rapidly in New York of late years, and apples have been unusually scabby. The wet spring afforded it just the conditions for rapid growth. The scab appears to be somewhat worse upon low and undrained lands than upon high and warm elevations, although in the infected regions the latter are never exempt. A closely related species (*Fusicladium pyrinum*), by some regarded as identical with the other, attacks the pear, in fruit and foliage, and probably causes much of the failure in the pear crop. It has a tendency to remain in more or less definite spots, so that pear foliage rarely looks as brown as apple foliage. The injury to trees by the fungus is not vital. It is best counteracted by spraying with solutions of carbonate of copper, beginning before the flowers open, and making four or six applications between then and the 1st of August. A solution of copper sulphate, carbonate of soda, and carbonate of ammonia is also recommended.

Advent of the Ghost Idea.—Lady Welby offered a puzzle to the British Association when she presented the question, which has not been solved, of accounting for the great "break" in human thought which occurs when the "ghost idea," or the thought of another life and the supernatural, comes in. The governing notion of those who regard the human intellect as a result of evolution is that man slowly accumulated experience, and from it, by comparison, by deduction, and by meditation, arrived at last at abstract and non-material thought. He considered the effect of revenge, for example, and its operation on tribal society, till he arrived at the idea of just revenge, or, as we call it, of justice; and, finally, his horizon ever widening, at the lofty conception that forgiveness might occasionally, or even frequently, be more to the general advantage, or, in other words, might be nobler, and therefore to be adopted. This theory leaves much unexplained, but it is supported by an array of facts, and will, if accepted, explain many of the phenomena. Much of thought is a result of experience and observation, and more may be; and it may be possible to extend

the result of teaching by experience till it covers most of the field of human intelligence. But a break occurs at the moment when the ghost idea intrudes. That can not be derived from experience; for no man has ever lived again the present life, nor has a ghost ever been observed except in fancy, and if in fancy, how did the fancy originate? It can not be explained, either, as the result of dreams, for, while people may dream odd things and whimsical combinations, they do not dream absolutely new things—that is, things outside their experience and outside the imagination developed from thinking about the collected results of experience either personal or inherited. Two suppositions are mentioned by the London Spectator in reviewing Lady Welby's paper as admissible on the subject. The first is that primitive man had evidence that he had seen or heard, at some time or other, that which inspired conviction in his mind, and became sure of another life because he had watched its manifestations. The other is that, whatever be the truth about the evolution of thought, some thoughts must be intuitional—that is, have been generated in man originally by some external power.

Chinese and Indian Tea.—The supremacy of the tea trade is gradually shifting from China to India and Ceylon to such an extent that the Chinese Government is said to have instituted an investigation into the matter. The cultivation of tea as an industry is hardly fifty years old in India, and not more than ten years old in Ceylon; yet the British importations from those countries almost equal in weight and exceed in money value those from China; and while the exports of China tea doubled between 1866 and 1886, those of Indian teas increased fourfold. The causes of the change were found by the Chinese investigation to rest largely in differences in the preparation of the commercial product. The Chinese method is characterized as careless. The crop is raised in small gardens by men who own them and whose capital is small. The picking is done by the family, with hired help only when it can not be got along without. To save expense it is pushed forward, and the plucked leaves are allowed to stand, deteriorating in quality, till it is finished. Consequently, the leaves are not evenly withered. In India, tea is grown in large gardens, under skilled superintendence, with thoroughly organized methods. The picking is attended to with extreme care, so that each leaf is plucked at the proper stage, the plants being gone over again and again as the leaves successively mature. The plucked leaf is started at once on the course of "making," so that no time is given for deterioration to begin. Like differences in care and system prevail through all the details and processes, down to the packing and transporting to market; and the Indian teas are prevailing by virtue of the real superiority which they thereby obtain.

Infant Serpents.—As described by Dr. Walter Sibley, in his paper in the British Association on The Incubation of Serpents' Eggs, the first sign of the process of hatching is a slit, usually V-shaped, appearing at the highest part of the egg-shell, whether the egg is placed on its side or on one end. The snout of the young reptile appears at the crack. After a time the head is protruded, and often remains out of the shell for some hours before the body and the tail are hatched. If disturbed, the head is again withdrawn into the shell. The author had seen fully-hatched young snakes return into their shells when alarmed. The young snakes, when first hatched, are smooth and velvety to the touch, with the yellow ring (of the common English snake) beautifully marked from the first, and the eyes open; but often there is some opacity about the cornea, which disappears in the course of a few hours. They are about six inches long, and weigh about eighty grains. They begin to hiss in the first few days.

Compressed Air as a Motor Power.—The power of compressed air was described by Prof. Alan Lupton, at the British Association, as suitable for large or small motors, and one that could be cheaply and safely introduced into workshops, houses, and shops. It will do the heavy work of a mill-course or iron-works, and the light work of the tailor, shoemaker, hair-dresser, and grocery, and will drive a dynamo for electric lighting. In Birmingham, by the agency of three steam-engines of 1,000 horse-power, air com-

pressed to a pressure of forty-five pounds above the atmosphere is delivered into pipes which are laid like gas-pipes over four miles of streets. The works had only left the hands of the contractors, when there were forty customers for air-power, some of them at a distance of a mile and three quarters from the compressing station. The loss of power by friction in the pipes is so light that no ordinary gauge will show it. The engines of the consumers vary in size from half a horse-power up to fifty horse-power. Under the system of Hughes and Lancaster, by which compressed air may be applied to tramways, a pipe is laid in the street for the supply of compressed air to the cars, which carry the machinery for propulsion. Any gradient which a locomotive can mount can be ascended by the cars, and fresh supplies of air can be taken in without stopping the cars.

Petroleum as an Explosive.—Experiments by Peter T. Austen exhibit petroleum as an explosive of the dangerous class. It evolves inflammable gases at ordinary temperatures, and some of them are not liquefied by a considerable reduction of the temperature. The author applying a match to a flask containing crude petroleum at zero Fahrenheit, the flask was filled with a blue flame. Since the evolution of gas is increased by shaking the oil, an inflammable gas must accumulate in the vacant parts of car-tanks, in a condition more or less favorable to explosion. If the gas in contact with the petroleum becomes ignited, the oil will, in most cases, take fire unless the body of the liquid is very cold; and the danger increases as the temperature. The behavior of a tank of petroleum under pressure has not been much studied; but all know how tinder may be ignited in a "fire syringe"—an effect of simple compression. The lubricating oil of the piston also takes fire—at a temperature of about 300°. The volatile gases of petroleum may be ignited at a lower temperature. If the mixture of air and vapor over petroleum is compressed to one fourth its volume, the temperature will be raised to 429° from zero, and to 499° from 70° Fahr. It follows, therefore, that if an oil-tank filled or partly filled with such a mixture is suddenly compressed in such a way as greatly to reduce its volume, the gas, and probably the oil, will be ignited by the compression. This might happen in a case of telescoping or of a fall of the tank. If a tank nearly filled with oil were suddenly compressed, the resistance offered by the liquid would heat it sufficiently to cause an evolution of its lighter hydrocarbons in sufficient quantity to create a dangerous pressure within the tank. This might happen when, the car being stopped in a collision, the oil is suddenly hurled against the front end of the tank. The author concludes that precautions against explosion are necessary in the transportation of crude petroleum.

Alcohol as a Cause of Disease.—Dr. Lewis D. Mason, of the Inebriate Asylum, Fort Hamilton, N. Y., discussing The Etiology of Dipsomania and the Heredity of Alcoholic Inebriety, determines as facts that alcoholism in progenitors will produce physical and mental degradation in their descendants, with the disorders that arise from a defective nerve organization; and all grades of mental weakening, from slight enfeeblement of intellect to insanity and complete idiocy; and that the laws regulating these changes are similar to those that govern congenital degenerative changes from other causes. The offspring of the confirmed drunkard will inherit either the original vice or "some of its countless Protean transformations." In another paper—on Pathological Changes in Chronic Alcoholism—Dr. Mason exhibits alcohol as modifying the serum and the anatomical elements of the blood, besides being an irritant and directly producing modification and degeneration of tissue, and therefore as being most evidently a disease-producing agent. Contrasting the little progress that has been made in the study of the pathology of chronic alcoholism and of the diseases incident to alcoholism with the great advance that has been achieved in knowledge of microbic diseases, he adds: "Alcohol has not any microbe, but the grand total of its mortality will exceed the combined effect of all the bacteria that have ever passed the microscopic field or developed in the culture-tube of the bacteriologist." The subject is now, however, beginning to receive some of the attention it deserves.

Leaf and Stick Insects.—The leaf insect and the walking-stick insect are curious creatures. All of the family to which they belong are nocturnal in habit, and spend their days resting on trees and bushes the leaves of which form their food. They so resemble the leaves and twigs as to escape all but the very keenest observation. In the leaf insect, the head and thorax form a stalk, while the abdomen, which is flat, thin, and much dilated, exactly resembles a leaf. The six legs have broad, membranous appendages on the upper part, which are especially noticeable on the fore-legs; so that the creature while resting has the appearance of a leaf that has been gnawed on both sides by a caterpillar. While the color of the insect varies at different periods of its life, it always more or less resembles a leaf at some stage; when settled on the leaves and eating at them, its body becomes bright green. After death it becomes brown like a dry leaf. The stick insects are common in the tropics, which are the principal habitat of the leaf insects, and are also found in temperate regions, including the United States. The tropical species are the largest, some of them reaching nine or ten inches in length. They are hatched from the egg in a form closely resembling that of their parents, coming into the world with three pairs of legs, which keep their shape with but little, if any, alteration during their entire existence, and which are all walking limbs. At all stages of their life they closely resemble sticks and twigs, either green and growing, or brown and withered, from which they obtain their name. They are also called specters, from their skeleton-like appearance and their slow, stealthy movements. A colony of these insects in the London Zoölogical Gardens is breeding prosperously.

Fort Ancient.—Mr. Warren K. Moorehead gave the American Association an account of his excavations of Fort Ancient, Ohio, and what he found there, in which he more fully elaborated the theory of the history of that work which was indicated in the volume upon it that we have recently reviewed. One of the points of this theory, based on the comparison of the potteries and implements found in and around the fort, and the burials, was that it was a point of contest, or battle-ground, between two races of men. Other questions occupied the author's mind as he considered the subject, and years, he said, might be spent in careful excavation of the graves and cemeteries, and there would still remain sufficient material to engage the attention of antiquaries for a long time to come. "This great inclosure, so rich in facts, so productive of implements that tell us of the every-day life of the ancient people who lived within its walls, may yet reveal to the patient investigator a history that shall go far toward dispelling the darkness that surrounds the origin and movements of ancient men on the American continent." The site has been bought by the State of Ohio, and will be preserved as a State park.

The Spectra of the Metals.—A paper by Prof. Rowland, of Johns Hopkins University, on The Spectra of the Metals, was received by the Physical Section of the British Association as a most important advance in our knowledge. The author had undertaken during the past year the measurement of the wave-lengths of the lines of nearly all the metallic spectra, and had compared them with the solar spectrum, in order to ascertain which metals were certainly present in the sun. The object of the research was primarily to find out what sort of things molecules are, and in what way they vibrate. This can be deduced from the wave-lengths of the light emitted if we can find any relation between these wave-lengths. If the molecules are spheres, we should have a series of bands getting gradually nearer together toward the violet, and representing harmonics of one fundamental vibration. A spheroid or ellipsoid would give a similar crowding, but not so uniformly arranged. The author had worked on a larger scale than in any previous observations, with negatives twenty feet long for the whole spectrum. He looked for and found many indications of the truth of the periodic law, which points to the fact that similar chemical substances have molecules vibrating in a similar manner. As examples, nearly every line in the spectrum of zinc has a corresponding one in that of cadmium; so also with calcium, strontium, and barium, and with potassium, cæsium, and rubidium. In

the case of several elements there is a band, consisting of three very bright lines, which it is supposed correspond to vibrations along the three principal axes of the molecule. But the agreement in the spectra of various metals does not extend to all members of the group. For instance, the spectra of beryllium and magnesium do not resemble those of the other alkaline metals. Lockyer supposed a fundamental basic line common to all the elements, but the author found no trace of it. Any line in the solar spectrum which is common to two elements Prof. Rowland considers to be so only by coincidence. Further dispersion would separate the line into two. Some elements give no lines, except in the ultra-violet—boron, for example. Probably most elements have lines beyond the limits of the photographic plate. The author doubts whether the platinum metals and uranium are present in the sun. Among substances not present are antimony, bismuth, arsenic, boron, gold, and nitrogen. On the other hand, many lines in the sun, such as D 3, correspond with no known metal.

Physical Development versus Consumption.—For several years Dr. G. W. Hambleton, President of the London Polytechnic Physical Development Society, has been publishing papers showing how physical development may be employed to counteract consumption. He has given the results of further researches in a communication to the British Association. His theory is that consumption is directly produced by conditions that tend to reduce the breathing capacity below a certain point in proportion to the rest of the body, and that it can both be prevented and recovered from by the adoption of measures based upon that interpretation of its nature. Tables were exhibited showing the measurements of one hundred of the two hundred members of the author's society who have already obtained an increase of chest-growth of one inch and upward. The average increase is a little over an inch and three quarters. A considerable increase was also obtained in range of movement. The increase has taken place in small as well as in large chests, whether the men were tall or short, under or over twenty-one years of age, and with or without gymnastic training. The subjects were engaged in more than fifty different trades and occupations, working in them from eight to twelve hours daily. The variations in chest-girth that took place during the year were also significant. Some of the members of the society were prominent members of the gymnasium, and as such had energetically prepared themselves for certain exercises there. On such occasions he had frequently noted a large decrease of the chest-girth. The girth also decreased when the men were much engaged in extra work, stock-taking, cycling, etc., or when they neglected to follow the directions given them. In fact, the increase or decrease observed was in direct relationship with a corresponding change in the conditions of their surroundings. But it is not only in the ordinary routine of daily life that this relationship between the chest-girth and the conditions to which it is subjected is manifested. In the treatment of consumption the author had obtained increases of from two to three inches and upward. This increase of the chest-girth is accompanied by a corresponding increase of the range of movement and of the vital capacity, and by a change in the type of chest from that of disease to that of health; for happily it could be said that the treatment of disease by this method had been invariably successful. What had been experimentally obtained had been also equally well obtained in the practical application of that research. One part of the investigations confirms the other, and the case as a whole is complete and practicable.

Fatness and its Treatment.—It is declared to be a misconception that fatness is in itself a disease. It only becomes morbid when, by mechanical pressure, fat impedes the functions of the organs, or by weight unduly burdens the body so as to exhaust the strength or make too large a demand on the resources of force and vitality. There is no certainty in trying to prevent fatness by any process of dieting, for "there are many ways of fat-making, and those persons who have a tendency to its production will make fat, however they are fed—in truth, almost as rapidly on one class of diet as on another. There are idiosyncrasies which may, in a limited number of in-

stances, be taken advantage of to check the tendency to form fat, but these specialties of the chemico-nutritive function are by no means common; and, speaking generally, it must be said that, except by starving the body as a whole, fatness can not be prevented." The exceptions to this rule are chiefly such as may be explained on the principle of a special tissue appetite. Thus some persons have a tendency to form muscle in excess, others to build up the nerves; and the last will grow thin while feeding well; and there are, in this way, persons whose specialty it is to make adipose tissue, and they will wax fat even when other parts of the organization are relatively in a condition approaching starvation. These and many other matters have to be taken into account when calculating the probabilities or improbabilities of success in the endeavor to diminish the fatness of any person by a system of dieting. Drugs, except when intelligently directed to some special morbid condition, have just as little influence in the matter.

Influenza and Children's Growth.—A systematic course of observations of the growth in weight of the children in the Deaf-mute Institution at Copenhagen has been kept up for seven years. Among the most striking results is the fact that the principal increase takes place in the fall months. Last fall (1889) the influenza appeared in Copenhagen toward the end of November. Six of the professors of the institution were attacked, while no pronounced cases were developed among the pupils. At the same time, for four weeks after the 23d of November, the weight of the boys increased only two fifths as rapidly as it had done in the corresponding weeks of the previous years, while the girls gained nothing. It is supposed that the vital force that usually went to increase of weight was for this occasion used up in resisting the germs of the disease.

NOTES.

THE conclusions expressed by Prof. Key, in the November number of the Monthly, respecting periods of growth in school children, seem to be confirmed by the measurements of Dr. Henry P. Bowditch in the schools of Boston. From these measurements, Dr. Bowditch observed in the National Academy of Sciences, it was shown that the big boys and girls get their growth earlier in life than the small boys and girls. The latter make up their relative proportion, but not till about a year later in life. The same fact was proved regarding height and weight. There was also shown to be a period of what the author called "female superiority," when the girls are the superiors in height and weight of the boys of the same age. This age is from about fourteen to sixteen years.

EXPERIMENTS are being tried in Germany in making horseshoes of a material the chief constituent of which is paper. It is said to fit to the hoof better than the iron shoe, to be impervious to water, and to grow rough under use, so as to become a safeguard against slipping.

M. ARMAND VIRÉ has discovered some dozen rocks in the valley of the Lunain, France, covered with smooth furrows running in various directions, which the people there believe to be scratchings of the devil's claws. They were used, it is supposed, during the Quaternary epoch, for finishing off the stone hatchets.

A PORTABLE boat has been devised by Colonel Apostoloff, of the Russian army, which may be constructed instantly by making a framework with the lances of the Cossacks and covering with a tarred cloth. Two boats are capable of carrying thirty-six men, with their baggage and arms.

MM. FREMY and Verneuil have continued their experiments in the manufacture of artificial rubies, which attracted attention several years ago, and, improving their processes, have made it successful on a considerable scale. They now obtain crystals weighing a third of a carat. In their later processes they add carbonate of potash to crude alumina, with bichromate of potash for color. The process, with the agitation of fluoride of barium, is continued for a week without interruption, at a temperature of 1350° C. Several times in the course of their experiments they have observed the red crystals of the ruby formed along with the violet and blue crystals of the sapphire. Mineralogy as well as jewelry is likely to profit by these operations, which are destined to cast light upon the coloring of gems.

PAINTED human bones have been found by Prof. Vasselovski in two prehistoric graves in the Crimea. Such bones had previously been found in three other graves. They are supposed to belong to the original inhabitants of the Crimea, the Cimmerians of Herodotus, who laid their dead on elevated spots till the birds consumed the flesh, and painted the skeletons, when they were bleached, with some mineral pigment. Painted skeletons have also been found in central Asia.

In some informal remarks at the meeting of the American Folk-lore Society, Dr. J. W. Fewkes gave the results of observations among the Zuñi Indians at Pueblo, which go to show how the traditions of the tribe survive in a kind of dramatic representation by dances. He thought that many historical events could be traced by making a careful study of the dances.

The trustees of the American Museum of Natural History have just opened a collection of the woods of the United States, gathered under the direction of Prof. Sargent, editor of Garden and Forest, and presented by Mr. Morris K. Jesup. It is nearly exhaustive, and represents four hundred and twelve species, including nearly all trees that are large enough to be considered of commercial importance. Attached to each species is a small colored map showing over what areas in the United States the wood is found, while near by are water-color drawings of flowers and fruit of the species, in nearly natural size and colors. In another hall are cases of specimens in economic entomology, illustrating the work of insects injurious to forest trees.

The latest attempt to solve the "smoke problem" is the scheme of Mr. Elliott, of London, for condensing the smoke in water and recovering the by-products. The smoke is drawn from the chimney by means of a fan into a tank of water in which revolving stirrers are moving; by these the products of combustion are churned up and arrested and condensed in the water. When the water is fully charged, it is drawn off, and the tank is filled with fresh water. The charged liquor is to be afterward treated, and the by-products due to the combustion of the coal are to be recovered.

According to a paper of Prof. John Trowbridge, the discharge from a Leyden jar is not a single act, but is a series of oscillatory movements back and forth till an equilibrium is reached. The oscillations take place in $\frac{33}{1000000}$ of a second.

A gigantic pendulum—a bronze wire, a hundred and fifteen metres long, with a steel globe weighing ninety kilogrammes at the end—has been suspended in the Eiffel Tower, for the purpose of demonstrating visibly the motion of the earth.

A leprosy commission has been dispatched from England to India, which, after an investigation of one year, is expected to report concerning the desirability or otherwise of encouraging the voluntary partial withdrawal of lepers from among the non-leprous population; of enforcing the complete isolation of all lepers; and of enforcing the isolation of certain lepers. It will also report on the best methods of accomplishing whatever may be decided upon.

The California Museum Association of Sacramento offers a prize of two hundred and fifty dollars for an invention to utilize the rise and fall of the tides, giving not less than three horse-power for six hours; also two hundred and fifty dollars for an inexpensive device to improve the hygienic conditions of the air in rooms. Inventors to retain all rights. Plans should be sent in by April 1, 1891. Full details on the matter can be obtained by addressing J. A. Woodson, president, Sacramento, Cal.

Dr. Charles A. Oliver has described, in the Transactions of the American Ophthalmological Society, a system of tests, and the apparatus required, which he has devised for detecting color-blindness in railway service. The first test consists in matching wools, being a modification of the Holmgren method; the second requires the recognition of squares of bunting in a series of black boxes at one thousand yards distance; and the third is like the second, except that illuminated colored glass is used instead of bunting, and the test is conducted at night. A spectacle-frame is also used in which different glasses can be inserted so as to produce the light effects of various sorts of weather. A number of advantages are claimed for the system.

In a paper in the Society for the Promotion of Agricultural Science, Prof. Manly Miles remarked that the interdependent biological relations of different farm crops and of the soil microbes that find favorable nutritive conditions in the vicinity of their roots appear to be as important factors in farm economy as the chemical constitution of soils and crops, and the conditions of soil that influence these relations are of great practical interest. The applications of science to agriculture will be best promoted by investigations concerning the life histories and relations of these microbes.

OBITUARY NOTES.

The French aëronaut, Eugène Goddard, died at Brussels, November 9th, in the sixty-third year of his age. He was famous for the numerous and daring ascensions which he executed in Europe and America.

Mr. James Croll, LL. D., F. R. S., author of Climate and Time, and other important works in cosmic science, died December 15th, in the seventieth year of his age. He was of humble birth and without scientific training, but "by sheer force of intellect" and by ability and industry he raised himself to a prominent position among scientific thinkers. His Climate and Time has received great attention, and his works on Oceanic Circulation and Stellar Evolution have been widely read. He had been suffering for several years from a painful disease.